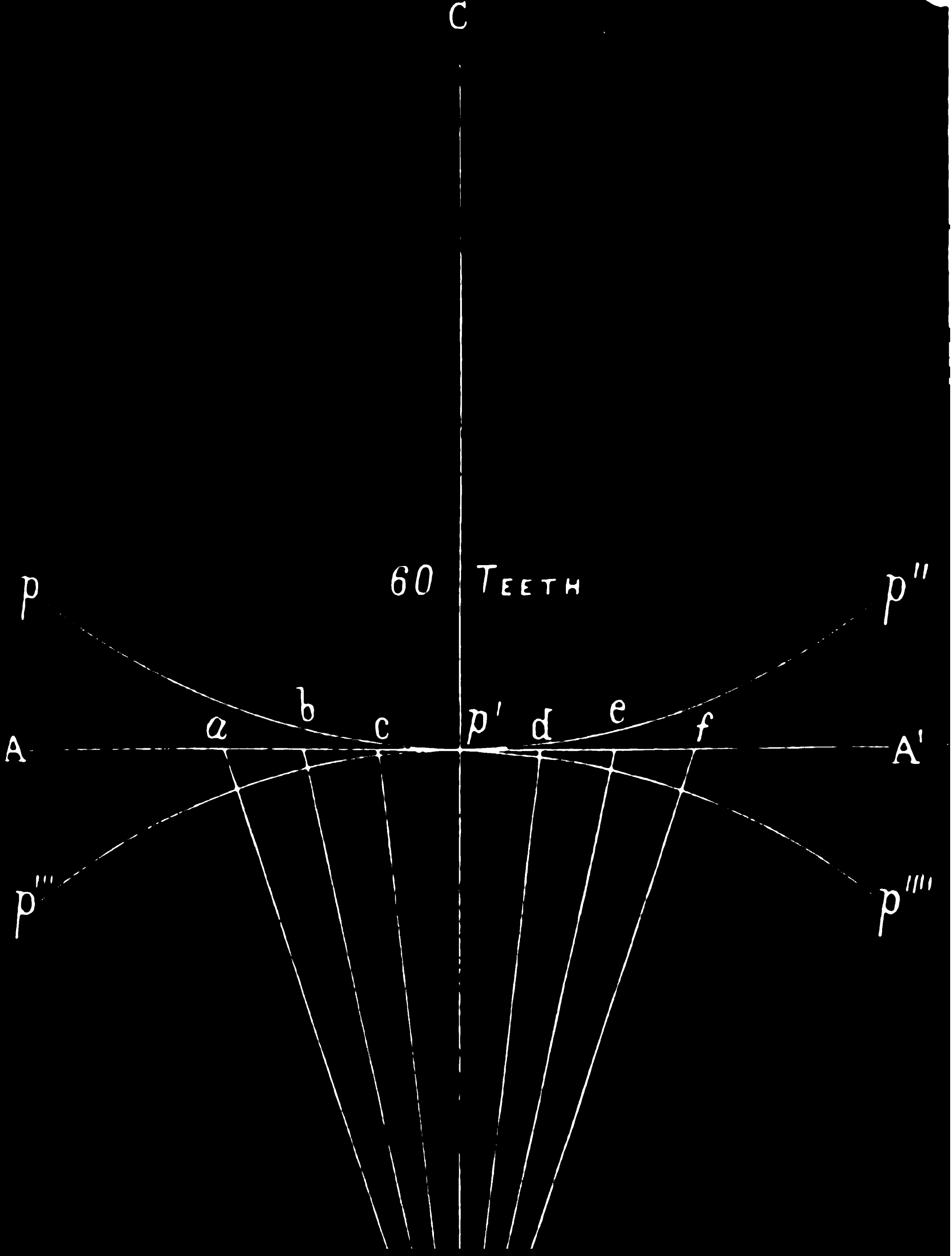


The Locomotive

Hartford Steam Boiler Inspection and Insurance Company

With compliments of

J. W. Allen *President.*

The Locomotive.

PUBLISHED BY THE

NEW SERIES.

Vol. IV.

HARTFORD, CONN.

1883

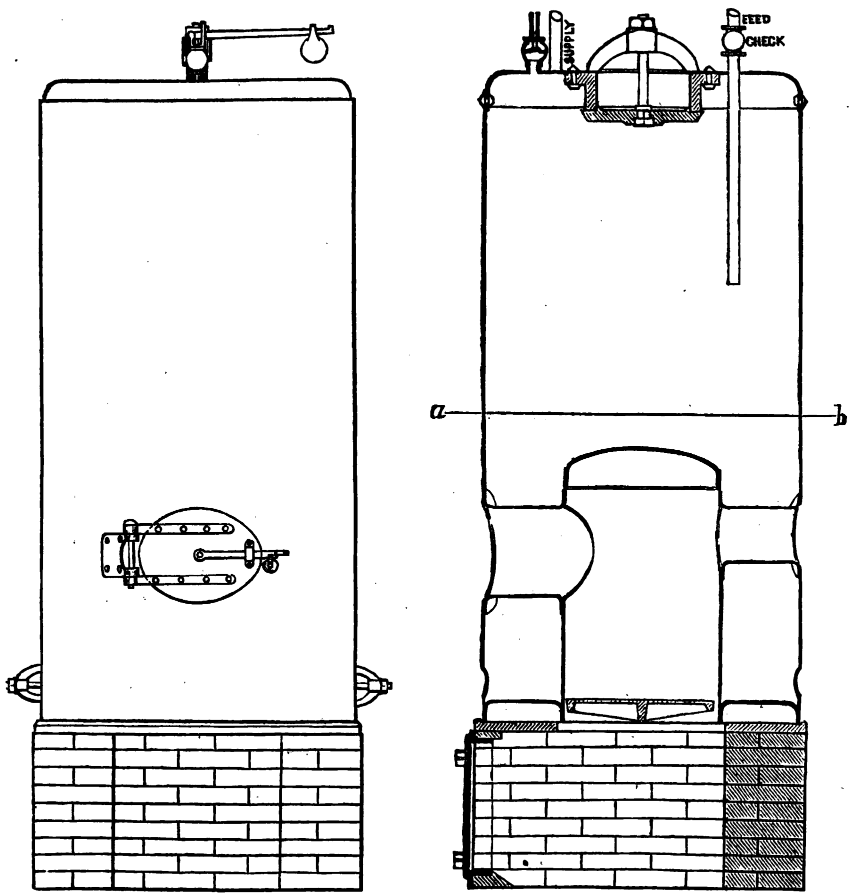
The Locomotive.

PUBLISHED BY THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY.

NEW SERIES—VOL. IV. HARTFORD, CONN., JANUARY, 1883. No. 1.

Upright Boiler for Heating Water.

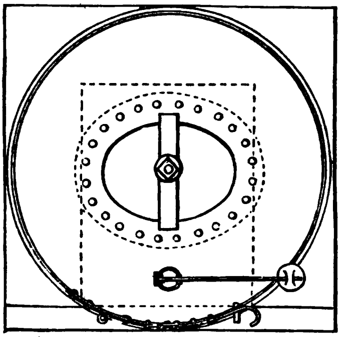
The boiler which we illustrate below is not for generating steam, but for heating water. It was designed by Mr. J. M. Allen, for the purpose of supplying hot water to



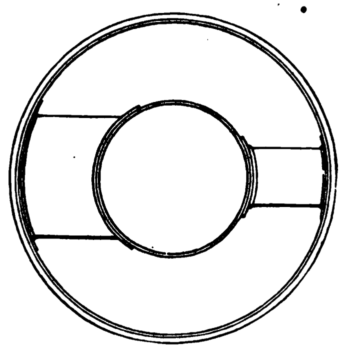
FRONT ELEVATION   SECTION

laundry, bath-rooms, and wash-bowls, in a large public institution. It is made of $\frac{1}{4}$ inch iron, riveted up in the same manner as an ordinary vertical boiler. It sets upon a brick or cast iron base, in which is the ash pit. The grate is of the ordinary hot air furnace

pattern, and can be easily shaken or "dumped." The furnace is small, as compared with the size of the boiler, being only 18 inches in diameter. The boiler is 36 inches diameter. This gives water legs, or water safes of about 9 inches. The door frame and mouth are flanged on to the boiler shell and furnace sheets. The smoke pipe or "out-take" is smaller, but attached in the same way. This hot water boiler can be set up anywhere, near a chimney. A common sheet iron stove pipe being all that is necessary to connect it with the chimney. It has three *hand-holes*, just above the bottom head for facility of cleaning. There is a man-hole on top, also a safety valve, and supply and



PLAN



SECTION ON a.b

feed pipes. The safety-valve is put on simply as a precautionary measure, in case the feed should become disarranged and steam be raised in the boiler. There is a long glass water-gauge, which is not shown in the illustration. This boiler is fed from the city pressure, which at the place where it is used is about 25 lbs. per square inch. The boiler is kept constantly full of water. Two hods (ordinary size), are usually sufficient fuel for a day's supply. The care is no more than would be required for a small cylinder stove.

As has been stated, it provides abundant hot water for laundry and bathing purposes for a public institution. We regard it as especially adapted to this purpose, and for boarding-houses, as well as private dwellings, where a larger quantity of hot water is needed than is supplied by the ordinary stove or range boiler. In places where a running supply of water, under sufficient pressure to supply rooms on different stories cannot be obtained, a tank must be used in the attic and kept full. The boiler, to be run economically, must be adapted in size to the needs of the place where it is to be used.

DYNAMITE SUPERSEDES THE AXE.—A Somerset county firm have a pulp manufactory, consuming spruce and hemlock timber. Their operations are large, and instead of practising the slow method of chopping down trees and sawing them up, in order to get the wood into the pulp-mill, they blow them to splinters with dynamite. An eye witness thus describes the process: A fine large spruce was selected, and a hole was driven in about ten inches, the chips were removed, and a dynamite cartridge was inserted. The dynamite comes in sticks like a candle and resembles moist brown sugar. A fuse was attached, and the men sought a place of safety. In a few seconds there was a mighty roar, and the great tree was lifted up in the air about ten feet, and then with a swoop and a crash it came to the earth, splintered half way up the trunk. Dynamite is not cheap; but, taking into consideration the time, labor, wear and tear of tools saved, is not as expensive as might be supposed.—*Lumberman.*

Inspectors' Reports.

NOVEMBER, 1882.

The one hundred and ninety-fourth monthly summary of the reports of the Company's Inspectors is given below, and will repay a careful perusal. From it we learn that 2,120 visits of inspection were made and 4,794 boilers were examined. The number of thorough annual internal inspections reaches a total of 1,875, and 376 boilers were proved by hydrostatic pressure.

The whole number of defects found which were considered sufficiently serious to be reported, was 3,334, of which number 686 were considered to be of so grave a nature as to impair the safety of the boilers in which they were found. The number of boilers condemned was 48. The usual analysis of defects is given below.

Nature of defects.	Whole number.	Dangerous.
Cases of deposition of sediment,	280	38
Cases of incrustation and scale,	428	38
Cases of internal grooving,	15	7
Cases of internal corrosion,	107	11
Cases of external corrosion,	157	36
Broken and loose braces and stays,	85	37
Settings defective,	83	16
Furnaces out of shape,	91	10
Fractured plates,	155	72
Burned plates,	97	33
Blistered plates,	185	19
Cases of defective riveting,	600	76
Defective heads,	56	21
Leakage around tubes,	393	134
Leakage at seams,	298	56
Water gauges defective,	58	16
Blow-outs defective,	38	11
Cases of deficiency of water,	13	7
Safety-valves overloaded,	27	6
Safety-valves defective in construction,	31	15
Pressure gauges defective,	135	24
Boilers without pressure gauges,	1	1
Defective feed pipe,	1	1
One dangerous defect unclassified,		1
Total,	3,334	686

THE straightening up of a tall chimney somewhere in Germany, which had become dangerous through the settling of the foundation on one side, by sawing through the joints on the convex side, has given rise to numerous paragraphs in both the scientific and daily papers. If our memory serves us rightly, the first case on record where this thing was done was at the mills of the Lawrence Manufacturing Co., in Lowell, Mass., some twelve or thirteen years ago. The chimney in question was a very large one, some 225 feet high, and canted to one side through unequal settling of the foundation, or other cause. It was brought back to a perpendicular position by passing a saw through the joints on the side from which it leaned, thus removing a narrow strip of mortar and allowing it to settle back to its original position.

Man-Hole Openings in Boilers.

It will we think be generally admitted that no boiler is complete without a man-hole through which admission may be had to the interior of the boiler for the purpose of examination, cleaning, or repairs. In the smaller sizes where this is impracticable there should be a number of hand-holes judiciously placed, through which the interior may be viewed, and also to facilitate removal of scales or deposit. An important matter too often neglected in the design and construction of boilers, is the location of the man and hand-hole openings where they will do the most good.

The best location for a man-hole is on the shell of the boiler, and its strongest form is where protected by an inside frame or mouthpiece accurately fitted and securely riveted on. Where steam domes are thought to be a necessary adjunct to a boiler, a common practice is to have a cast iron dome head with the steam pipe nozzle and man-hole cast in. This is a weaker form than the one first described, for it leaves the opening in the shell beneath the dome without re-enforcement, while it is much more difficult,—sometimes impossible to get inside the boiler after it is set, owing to the steam piping being in the way.

In our larger cities where ground space is limited, boilers are often placed in vaults or sub-cellars, where the overhead room is limited, which often brings the dome close up under the vault or ceiling, where it would be impossible for even the smallest child to get inside the boiler through the man-hole, owing, as we have pointed out, to the contracted space and net work of steam-pipes and connections. We have knowledge of cases in which it was necessary to cut away a portion of the ceiling or vault covering, sufficient to gain access to the inside of the boiler, which involved considerable expense and trouble, besides to some extent weakening the structure; the cases we have in mind were planned by architects of good repute, and the work executed under their direction. Without engineering experience they did not realize the importance of setting boilers in such a manner as to make them accessible, thus illustrating the necessity of consulting the most competent advisors in planning and executing steam engineering work. In every case there would have been no trouble in gaining access to the boiler, had the man-hole been upon the shell, instead of on the top of dome. We have always favored its location upon the shell because we believed it best for all purposes of strength and accessibility.

The horizontal tubular boiler, owing to its simplicity, compactness, strength, and accessibility, is a great favorite among steam users, and increases in public favor every year. It admits of a variety of modifications and disposition of tubes by which it may be adapted to the wants of different localities, fuels, and feed waters. To facilitate the cleaning of the sheets over the fire in localities where the feed water forms a troublesome scale or a deposit of sediment from muddy water, a clear space of ten or twelve inches is left between the bottom row of tubes and boiler bottom, and a man-hole put in the front head. In our plans and specifications this man-hole opening is re-enforced by a suitable frame, same as that used on the shell. Ordinarily, manufacturers simply re-enforce it by a strengthening ring. In one case in which two new boilers were offered us for inspection and insurance there was neither strengthening ring, stays nor reinforcement of any kind. The man-hole was 10x14 inches, heads 60 inches in diameter, and the boilers were designed for a working pressure of 70 pounds per square inch.

Our inspector recommended the addition of a strengthening ring or stays, preferably the former, but the party who furnished the boilers said there was no necessity for either; he never used anything of the sort in his boilers. It may be remarked incidentally that had he deemed this alteration necessary he would have been required to do it at his own expense. The boiler in this condition of course was regarded as uninsurable.

The great advantage of properly located man and hand-hole openings are their utility. This we think is not always appreciated; sometimes they are regarded as ornamental appendages. We know of exceptional cases in which they had not been removed for a number of years; meanwhile scale or a deposit of sediment had accumulated to a dangerous extent and nearly ruined the boiler, the excuse offered by those in charge being that the joints of the plates were tight and they were afraid to take them off for fear they would leak when put back. With proper care in scraping off the old material from the face of the joint before it is remade, that is when the old gasket cannot be used over again, there should be no trouble.

Some of our friends claim that a light wash of black lead and oil applied to the face of the gasket facilitates its removal when the joint is broken again; by this means they can use the same gasket a number of times. There are various other preparations used by engineers to accomplish the same purpose. Within a few years, special attention has been given to the manufacture of rubber gaskets for man-hole joints, that would give better satisfaction and be more durable than those heretofore used. They may be had of dealers in machinery supplies in all parts of the country.

With a suitable gasket free from gritty particles which are sometimes found adhering to it, there should be no trouble in making a tight joint at the man or hand-hole plates; if there is it indicates distortion either of the plate or its seating, in hand-holes possibly a weakness due to dangerous thinning of the shell by corrosion around the opening; in either case, the pressure should be lowered and the boiler put out of service until an inspector can be summoned to determine the cause, and make a suitable recommendation. Do not try excessive screwing up to stop the leak; that is a very dangerous plan, in which many inexperienced or reckless men have lost their lives. Tightening a joint under steam pressure is attended with great danger under any circumstances. When the joint is about the boiler it is doubly so. Under proper conditions ordinary screwing up should give a tight joint; when it does not something is wrong, and what that something is must be determined by an examination. F. B. A.

Russian Railway Employees.—It is stated that the Russian railway companies find it extremely difficult to obtain native employés for anything above manual labor. At present half the engine-drivers upon Russian lines are Germans, and to remedy this state of things the companies have instituted schools with the view of training boys as engine-drivers, stokers, telegraph operators, etc. There is a preparatory course of one year for candidates who cannot read or write, and the ordinary course of instruction lasts three years, and for some departments is followed by two years of a working apprenticeship. All pupils who have passed through the school are bound to serve two years with the company whose school they have attended. There are now 33 of these schools in existence, but they cannot be said to have passed beyond an experimental stage, as the oldest, which was established in 1872, has thus far turned out only 25 employés.—*Engineering.*

A new use has been discovered for potatoes. They can be converted into a substance resembling celluloid by peeling them, and after soaking in water impregnated with sulphuric acid, drying and pressing between sheets of blotting paper. In France, pipes are made of this substance, scarcely distinguishable from meerschaum. By subjecting the mass to great pressure, billiard balls can be made of it, rivaling ivory in hardness.—*Cotton, Wool, and Iron.*

The Locomotive.

HARTFORD, JANUARY, 1883.

THE opening of a new year is always fraught with hopeful anticipations and with anxiety as well. We look upon the old year as finished and its record closed up. We say we know what we have accomplished, and how much we have gained in this or in that direction. But do we stop to think that the efforts of the past lap over on to the future, and that the successes or failures before us will be largely dependent upon the methods and means employed in the past. If we do not learn wisdom by experience, we shall make no progress. If we are simply willing to plod along in a path that is smooth and easy, because it is easy, we shall leave no mark to show that we have had a place among men. There is no easy spot for active, progressive men to-day.

The air is full of discovery and invention, surprise follows surprise as great achievements are announced, and we wonderingly say, "what will come next?" Now it must not be forgotten that these wonderful strides are not the result of the labors of one day or one year, but of the patient, painstaking toil of years, mingled with discouragements, disappointments, and setbacks many and grievous. No great enterprise is built up in one year; hence the records of any one year, as looked upon by those who are building and expanding, can only be an integral part in the work which has but partially attained its growth. Other years of toil must be added, not only to enlarge and perfect, but to undo and eliminate the mistakes and the errors of the past. So the year before us is full of hope and possibilities. But good use must be made of the real substantial things that have been done in the past. They lap over like mighty cords to bind the good of the past to the valuable things to be accomplished in the future. Bad methods, while favored for a time with apparent success, will in the end prove a failure, because the foundation is wrong, and the superstructure has no reliable support, but rocket like, it sooner or later comes down a stick. Now, with all the discouragements that the future has in it, to business men—we mean the disturbances that come from political agitations and unwise legislation, causing stagnation in business, want of confidence, and all the evils that follow in the train—there is much that is encouraging. We have a vast country, wonderful in resources, with a rapidly increasing population, that must be fed, clothed, housed, transported and taken care of, and we also have much to do for other nations, who are mightily taxed to suitably care for their own populations. Hence a legitimate business well managed, strengthened by wise methods in the past, adapting itself to the varying lines and fluctuations of trade in the future, willing to be modest, and make haste slowly, lengthening its lines gradually and cautiously, but strengthening its stakes firmly, will grow. It cannot help it. Honest work will tell in the end, and although there may be some bare spots, like the snow ball the accumulations will be larger as each year rolls round. Then let us all take courage and believe that the coming year will be a prosperous one, *and it will.*

Unclassified Data.

BY J. H. COOPER.

No. 3.

Effects of temperature on the tensile strength of boiler plate. Styffe, p. 144.—"Low Moor iron which broke under 59,081 lbs. per square inch at a 60° temperature, required 66,355 lbs. to break it at a temperature of 323°.

Another specimen which failed at 52,837 lbs. at a temperature of 60°, had its strength increased to 69,717 lbs. at 318°, but fell back in strength to 62,556 lbs. at 419, showing that the maxumum tenacity was passed somewhere between the temperatures of 300° and 400°."

See also Experiments of the Franklin Institute Committee in 1837, and those of Styffe in 1869.

Holley, Railway Practice, New York, 1867, p. 39:

"Pitch of Rivets.—For $\frac{3}{8}$ inch and $\frac{1}{2}$ inch iron plates, $\frac{3}{4}$ inch rivets at 2 inch centres were found by trials to be as strong as the plates. Steel rivets, the material being stronger, may be placed further apart, allowing less section of plate to be cut away by the holes. On the North London road $\frac{5}{8}$ inch steel rivets pitched at $1\frac{3}{4}$ inches were found to make a stronger joint than $\frac{7}{8}$ inch iron rivets similarly pitched."

P. 34. "It may thence be inferred from Mr. Brunel's experiments on riveted joints on a large scale that the maximum strength is obtained when the riveted sectional area of the rivets to resist shearing is equal to the sectional area of the plate through the line of rivet-holes."

Nystrom, "Steam Engineering," p. 102:

"Proportion of single riveted lap joints with punched holes, to the nearest $\frac{1}{16}$ of an inch, as used in practice.

Thickness of Plate.	Diameter of Rivets.	Pitch of Rivets.	Lap.	Area of Rivet.	Area of Plate.	Per cent. of Solid Plate.
$\frac{3}{16}$	$\frac{7}{16}$	$1\frac{5}{16}$	$1\frac{1}{2}$	.1503	.1640	66
$\frac{1}{4}$	$\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	.1963	.2500	66
$\frac{5}{16}$	$\frac{5}{8}$	$1\frac{7}{8}$	2	.3067	.3906	66
$\frac{3}{8}$	$\frac{3}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	.4417	.5625	66
$\frac{7}{16}$	$\frac{13}{16}$	$2\frac{3}{8}$	$2\frac{3}{8}$	.5184	.6836	65
$\frac{1}{2}$	$\frac{7}{8}$	$2\frac{1}{2}$	$2\frac{1}{2}$	.6013	.7525	64
$\frac{9}{16}$	1	$2\frac{5}{8}$	$2\frac{5}{8}$	.7854	.9140	63
$\frac{5}{8}$	$1\frac{1}{16}$	$2\frac{3}{4}$	$2\frac{7}{8}$	.8904	1.0546	62

For drilled holes make the distance between the centres of the holes $\frac{1}{8}$ inch less."

Mr. Fairbairn, in 1838, experimented on plates of iron, twenty-two hundredths of an inch thick; 3 to $3\frac{1}{2}$ inches wide, riveted in various ways and then torn asunder. He considered that the friction of the plates by the bond of the rivets and the greater number of rivets usual in the wider plates of boiler work, made a stronger joint than that shown by his experiments, from which he established the oft quoted numbers 100, 70, and 56, representing the strength of the solid plate, the double riveted joint, and the single riveted joint respectively.

On the Effects of Heat.*—Com. of the Franklin Inst., 1837.

"163 experiments at ordinary temperatures showing a mean tensile strength per square inch of 57,525 lbs. Up to a temperature of 825° Fah. the tensile strength does not fall below 50,000 lbs. to the square inch.

* These Experiments are understood to refer to iron plate.—Ed. Locomotive.

At 1,000° Fah. it falls to 37,000 lbs., nearly.
At 1,100° Fah. it falls to 27,000 lbs., nearly.
At 1,200° Fah. it falls to 22,000 lbs., nearly.
At 1,300° Fah. it falls to 19,000 lbs., nearly.

"The mean of fourteen experiments shows a ratio of elongation to breaking weight of 641 to 1, in irons breaking from 40,643 lbs. to 68,513 lbs. per square inch."

ON THE EFFECTS OF ANNEALING.—"Seventeen comparisons of the strength of specimens of boiler plate after annealing showed a tensile strength of 45,117 lbs. per square inch."

COLLAPSING OF CIRCULAR FURNACES.—"The strength of furnaces to resist collapsing pressures to be calculated from the following formula: $\frac{89,600 \times T^2}{L \times D}$ = working pressure lbs. per square inch, where 89,600 = constant.

T = Thickness of plate in inches.
D = Outside diameter of furnace in inches.
L = Length of furnaces in feet. If rings are fitted the length between rings to be taken.

The pressure in no case to exceed $\frac{8,000 \times T.}{D.}$

Thomas Cargill, London, 1873, p. 16, says:

"A tensile strain exceeding 12 tons to the square inch will injure the elasticity of wrought iron and permanently damage its utility and strength."

WORKS IN IRON.—E. Matheson, London, 1873.

"The maximum amount of strain which any piece of iron will endure without losing its capacity of returning to its original condition when the force is withdrawn is called it 'limit of elasticity,' and in wrought iron under a tensile strain this limit or commencement of permanent set occurs at about *half its breaking strain*, the exact point varying with the quality of the iron and the kind of treatment to which it has been subjected during manufacture."

It is the general practice of engineers in designing bridges, roofs, and other structures, to give such dimensions and thickness of iron as shall involve only a working strain of from 4 to 7 tons per square inch; 5 tons for railroad bridges as the utmost.

Trautwine, Philadelphia, 1872, p. 178:

"In important practice good bar iron should not be trusted permanently with more than 5 tons per square inch, which will stretch it about $\frac{1}{8}$ inch in 25 feet.

"The elastic limit under tension usually ranges between 8 and 12 tons per square inch, or nearly half the breaking strain, according to quality."

"The strongest wrought iron stretches less before breaking than weaker specimens, and is therefore more apt to snap under sudden blows or strains.

"Heating up to 600° Fah. does not weaken bar iron. Its elastic limit under pressure averages about 16 tons per square inch. It begins to shorten perceptibly under 8 to 10 tons but recovers when the weight is removed. With from 18 to 20 tons it shortens permanently about $\frac{1}{80}$ part of its length."

Trenton Iron Works "Notes for Engineers for Basis of Strength," p. 31:

"The limit of elasticity for wrought iron is about 21,000 lbs. per square inch. Experiments on the effects of repeated applications and removals of the load, accompanied with considerable vibration, appear, however, to show that where a wrought iron beam may be subjected to such repeated applications of the load an indefinitely great number of times, the maximum stress should not exceed 16,000 lbs. per square inch."

Useful Information for Engineers by Phoenix Iron Co., p. 49, says:

"In reference to tests of bars of iron for the Niagara Bridge," the recovery of each bar after the removal of the proof load, 20,000 lbs. per square inch, was perfect, no permanent set occurring at less than 25,000 lbs.

Bourne, Hand Book of the Steam Engine, London, 1865, p. 461:

Quotes Fairbairn's proportions of rivets and riveted joints, his 34,000 lbs. as the strength of a single riveted joint, and his factor of safety of 6, but believes Mr. Fairbairn's margin of safety is too small, and therefore gives a rule of his own based upon a factor of safety of $\frac{1}{7.6}$ of the bursting pressure embodied in the following formula:

$P = \frac{8,900\ t}{d}$ in which

P = Safe working pressure in lbs. per square inch.

t = Thickness of boiler plate in inches.

d = Diameter of boiler in inches.

Mr. Bourne goes even further than this towards a higher factor of safety. He says: "This rule gives the strain about one-fourth of the elastic force or 4,450 lbs. per square inch of sectional area of the iron; but 3,000 lbs. is enough when the flame impinges directly on the iron as in some of the ordinary cylindrical boilers, and the rule may be adapted for that strain by taking* 6,000 as a divisor instead of 8,900.

In this connection he quotes the Messrs. Napier's strength of Yorkshire plates at 55,433 lbs. with the grain, and the tensile strength of ordinary "Best" and "Best Best" boiler plates as manufactured by ten different makers, which were found to be 50,242 lbs. with the grain, and 45,986 lbs. across the grain, giving a mean of 48,114 lbs. per square inch of section.

In his Catechism of the Steam Engine, London, 1865, p. 189, he says:

"The iron of boilers, like the iron of machines or structures, is capable of withstanding a tensile strength of 50,000 to 60,000 lbs. upon every square inch of section; but it will only bear a third of this strain without permanent damagement of structure, and it does not appear expedient in any boiler to let the strain exceed 4,000 lbs. upon the square inch of sectional area of metal, especially if it is liable to be weakened by corrosion."

It is plain to be seen that Mr. Bourne's rules are based upon his opinion of the margin of safety, rather than upon the capabilities of the materials upon which he figures. For with Fairbairn's joint, and with iron equal to the best average English, which he gives, boilers ought to be safe with a factor of 6, whether made by Fairbairn or Bourne.

Barr on Boilers, p. 148:

"The ultimate strength of a boiler is the greatest pressure which it is capable of withstanding without danger of rupture.

"A factor of safety in steam boilers is a unit employed to show in what proportion a given pressure is less than the ultimate strength of the boiler.

"The numerical value given a factor of safety is the relation which it bears to the ultimate strength, and not that of the elastic limit. Just what that figure should be for boilers has never been agreed upon, but has been narrowed down to either 6 or 8. So that in ordinary boiler construction for land use no very great discrepancies are likely to occur by the use of either in the regular course of business.

"In this country 6 is the ordinary factor of safety employed in all kinds of boiler work; in England it varies between 6 and 8. The elastic limit of wrought iron is not far from one-half its tensile strength."

Practical Notes on the Steam Engine. W. H. King, U. S. N. New York: 1863, p. 156, says:

"The experiments of the Franklin Institute give for the strength of single-riveted seams, 56 per cent. of the sheet, assumes the tensile strength of the best English iron to be 60,000 lbs. per square inch of section, and that one-fourth of the bursting strength would be safe to subject a boiler to in practice."

* The formula as modified for a higher factor of safety would read: $P = \frac{6,000\ t}{d}$.—Editor Locomotive.

Table showing the Character and Efficiency of American Coals.

The following Table, abstracted from Shock's work on Steam Boilers, shows the comparative value and efficiency of the principal varieties of coal used in the Eastern and Middle States. It is the result of the investigations of Prof. W. R. Johnson from 1842 to 1844.

KIND OF COAL.	Location of mine.	Specific gravity.	Cubic ft. of space required to stow a ton.	Volatile combustible matter in 100 parts.	Fixed carbon in 100 parts.	Earthy matter in 100 parts.	Moisture in fuel in 100 parts.	Ratio of fixed to volatile combustible matter.	Rate of combustion in lbs. of coal per sq. ft. of grate per hr.	Percentage of waste in ashes and clinker.	Lbs. of steam from water at 212° per lb. of coal.	Steam from 212° from one lb. of combustible.
Beaver Mead., Slp. No. 3,	Pa.	1.610	40.78	2.38	88.94	7.11	1.57	37.37	6.69	11.96	9.21	10.462
" " " 5,	Pa.	1.551	39.86	2.66	91.47	5.15	0.72	34.39	6.27	6.74	9.88	10.592
Forest Improvement,..	Pa.	1.477	41.75	3.07	90.75	4.41	1.77	29.56	6.52	6.97	10.06	10.807
Peach Mountain,......	Pa.	1.464	41.64	2.96	89.02	6.13	1.89	30.09	6.69	6.97	10.11	10.871
Lehigh,...............	Pa.	1.590	40.50	5.28	89.15	5.56	0.01	16.88	6.95	7.22	8.93	9.626
Lackawanna,.........	Pa.	1.421	45.82	3.91	87.74	6.35	2.00	22.44	6.45	8.93	9.79	10.764
Lykens Valley,........	Pa.	1.389	46.13	6.88	83.84	9.25	0.03	12.19	6.92	12.24	9.46	10.788
N. Y. and Maryland Mining Company,	Md.	1.431	41.71	12.31	73.50	12.40	1.79	5.97	6.28	12.71	9.78	11.208
Neff's Cumberland,....	Md.	1.337	41.26	12.67	74.53	10.34	2.46	5.88	7.86	10.96	9.44	10.604
Dauphin and Susq'h'na,	Pa.	1.443	44.32	13.82	74.24	11.49	0.45	5.37	6.86	16.36	9.34	11.171
Blossburg,............	Pa.	1.324	42.22	14.78	73.11	10.77	1.34	4.95	7.77	11.20	9.72	10.956
Lycoming Creek,......	Pa.	1.388	40.45	13.84	71.53	13.96	0.67	5.16	6.33	16.92	8.91	10.724
Cambria County,......	Pa.	1.407	41.90	20.52	69.37	9.15	0.96	3.38	6.68	9.75	9.24	10.239
Midlothian, Average,..	Va.	1.294	41.45	29.86	53.01	14.74	2.39	1.78	6.68	14.83	8.29	9.741
Pittsburg,.............	Pa.	1.252	47.85	36.76	54.93	7.07	1.24	1.49		8.25	8.20	8.942
Cannelton,............	Ind.	1.273	47.01	33.99	58.44	4.97	2.60	1.72	11.09	5.12	7.34	7.734
Dry Pine Wood,.......			106.62			0.307			15.87	0.307	4.69	4.707

OBSERVATIONS made by M. Rafford, a member of the Société d' Horticulture at Limoges, show that a castor-oil plant having been placed in a room infested with flies, they disappeared as by enchantment. Wishing to find the cause, he soon found under the castor-oil plant a number of dead flies, and a large number of bodiés had remained clinging to the under side of the leaves. It would, therefore, appear that the leaves of the castor-oil plant give out an essential oil, or some toxic principle which possesses very strong insecticide qualities. Castor-oil plants are in France very much used as ornamental plants in rooms, and they resist very well variations of atmosphere and temperature. As the castor-oil plant is much grown and cultivated in all gardens, the *Journal d'Agriculture* points out that it would be worth while to try decoctions of the leaves to destroy the green flies and other insects which in summer are so destructive to plants and fruit trees.—*Knowledge.*

AN exchange says that a locomotive engine which dropped into Kiowa Creek, Kansas, through a bridge some years ago, has never been recovered or even discovered, although repeated soundings have been made for it. No indications of quicksand in that locality existed up to the date of the accident.

Laying Off Angles.

The draughtsman, machinist, pattern-maker, or other mechanic is often obliged to lay off angles consisting of a certain definite number of degrees and minutes. To do this an instrument called a protractor is generally used. The protractor consists, in its cheapest form, of a circular or semicircular piece of horn or brass with the degrees marked near the periphery. The diameter of these cheap instruments is usually about four inches. As may readily be imagined, no approach to accuracy is possible with such an instrument. Very elaborate protractors are made, however, by which a fair degree of accuracy may be attained. These higher priced instruments consist of a whole circle of German silver, with the graduation marked near the edge, and are provided with an arm turning around the centre of the circle, which arm carries a vernier scale reading to minutes. One side of this arm forms a ruler pointing toward the centre of the circle, and angles may be very accurately laid down to the nearest minute. Their price, however (from $25 to $95) renders them an exceedingly poor investment for the average mechanic or draughtsman.

The best way known to the writer to lay off any required angle to any degree of accuracy does not require the use of any other instruments than the ordinary T square and scale, and a lead-pencil. These instruments, it will be seen, are those absolutely required to make any drawing. Even the T square may be dispensed with, and an ordinary pair of dividers used in its stead. This method may be briefly described as follows:

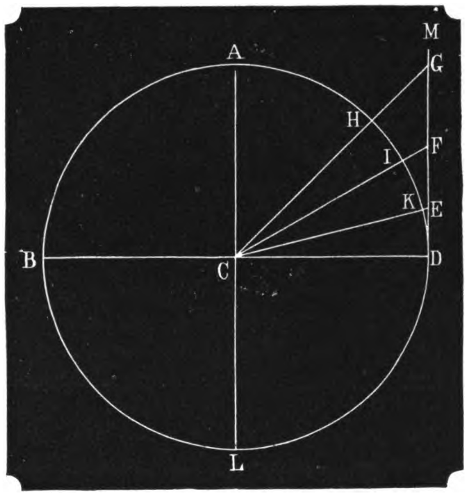


Fig. 1.

First, for the benefit of our readers who have never had an opportunity to become familiar with geometry, we will explain what the tangent of an angle is. Draw a circle as shown, Fig. 1, having a radius of one inch. Draw the diameter BD, and another diameter AL at right angles or "square" with BD. Then draw the line DM from the point D, just touching the circumference of the circle, and perpendicular to BD. Now suppose we draw a line CK from the centre of the circle to the point K in the circumference. This line will make a certain angle with the radius CD, and is measured by the part DK of the circumference lying between D and K, and may always be expressed in degrees, minutes, and seconds. A degree is measured by $\frac{1}{360}$

part of the circumference of any circle. A minute is $\frac{1}{60}$ of a degree. A second, $\frac{1}{60}$ of a minute. Now prolong the line CK from K until it cuts the line DM at E. Then the distance DE is the *tangent* of the angle DCK. In the same manner DF is the tangent of the angle DCI, and DG is the tangent of the angle DCH. If the radius of the circle is 1 inch, and the angle DCE is 15 degrees, then the tangent DE will be equal to .268 of an inch. If the angle DCF is 30 degrees, its tangent DF is equal to .577 of an inch, and so on. These dimensions may be proved by measuring the above diagram.

If the radius of the circle be made equal to *two inches*, the tangents would be just *twice* as long; if the radius were *three inches*, they would be *three* times as long as they are when the radius is one inch, and so on for any radius.

A Table of Natural Tangents is a table where the tangent of every degree and minute up to 90 degrees has been calculated for a radius = 1. If we wish to know the tangent to a radius equal to 2 or 3 we have only to multiply the tangent found in the table by 2 or 3, and we have its length at once. Every engineer's pocketbook contains such a table, and no mechanic should be without one.

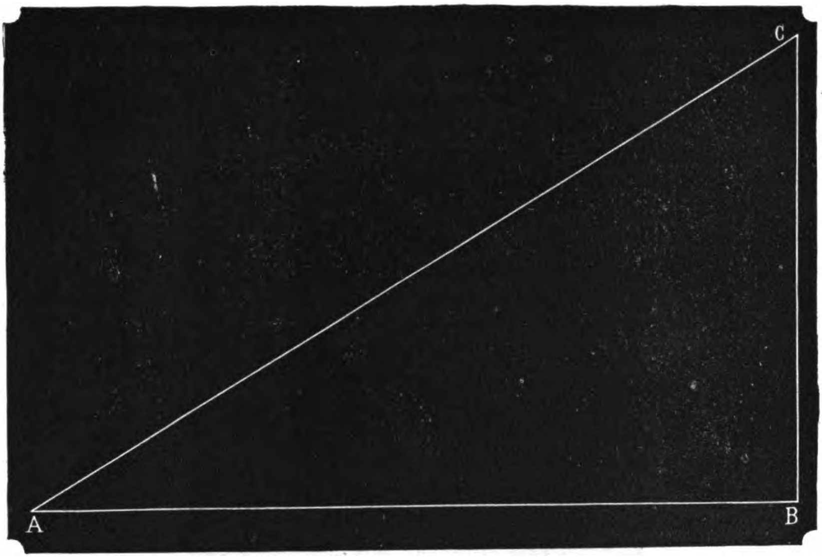


FIG. 2.

We are now ready to lay off our angle. Suppose we have given the line AB, Fig. 2, and wish to lay down another line AC which shall make an angle of 31 degrees and 17 minutes with AB. Draw BC perpendicular to AB, and say 4 inches from A to B. Look in the table for the tangent of 31° 17'. This we find to be .6076. Multiply this by 4, and we have 2.43 inches. Lay off BC = 2.43" and draw AC. Then the angle CAB = 31° 17'; proceed in the same manner for any other angle.

The most convenient length to make the line AB is 10", then the tabular tangent is to be multiplied by 10, which is performed by simply moving the decimal point one place to the right.

One of the most convenient applications of this method is the division of the pitch circles of gears having an odd or prime number of teeth. This is generally accomplished by trial stepping around the pitch circle with a pair of dividers. Any one who has had anything to do with gears knows the tediousness and uncertainty of this process. The

method above described for laying off angles may be used in this case in the following manner: Let $p\ p'\ p''$ and $p'''\ p'\ p''''$, Fig. 8, represent portions of the pitch circles of two gears which are to have 59 and 60 teeth respectively, as shown. Suppose we wish to lay off the pitch on the pitch circle of the 59-toothed gear. Divide 360, the number of degrees in a circle, by 59, the number of teeth in the gear $p'''\ p'\ p''''$. This gives us 6° 6′ 6.1″ as the angle subtended by the pitch. Now draw AA′ through p', at right angles to CC′. Lay off from p', $p'd =$ to the tangent of 6° 6′ 6.1″ × the radius of the gear. Then

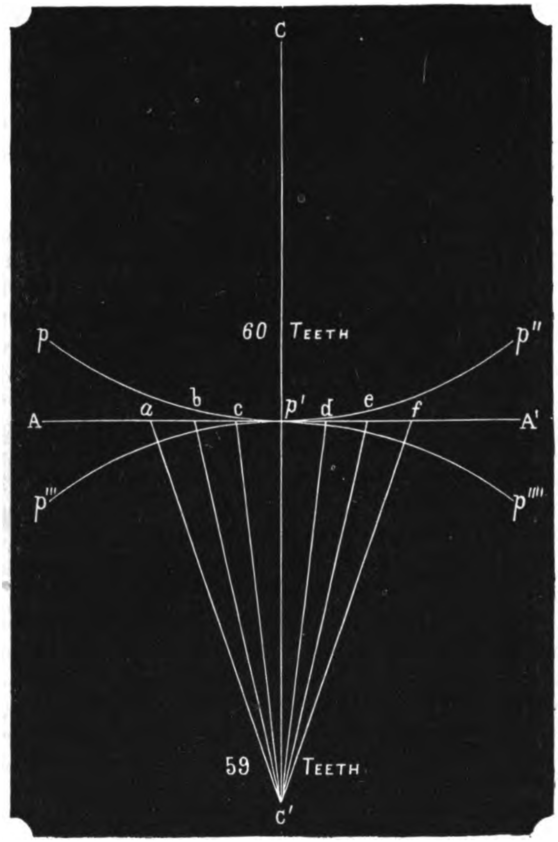


FIG. 8.

double 6° 6′ 6.1″; this gives 12° 12′ 12.2″. Lay off the tangent of this angle $p'e$ in the same manner. Treble 6° 6′ 6.1″. This gives 18° 18′ 18.3″. Lay off its tangent $p'f$ as before, and so proceed until the tangents of the angles subtended by the required number of teeth have been determined. Then draw lines from the points *a*, *b*, *c*, *d*, *e*, *f*, etc., to the centre of the circle. The points where these radial lines cut the pitch circle will be the required pitch points.

The writer has used the above method of laying off angles and dividing the pitch circles of gears for a long time, and has always found it to give perfect satisfaction. It certainly admits of a degree of accuracy which cannot be obtained in any other way, and that, too, without the use of expensive special instruments. H. F. S.

Luminous Paint.

The color of the light is generally white, or, at first, bluish. Hyposulphite of strontium, or equal parts of carbonates of strontium and sulphur, when ignited for twenty or twenty-five minutes, at first over an ordinary Bunsen burner and then over the blast lamp, give a green light, while carbonate of barium and carbon give an orange-yellow light. The pure sulphides do not give any light at all. Hence the chemical composition of luminous paint alone does not condition its power of giving out light, since of two substances having the same composition, one may be luminous while the other is not. It seems rather as if the power of giving light depends not only on the correct chemical composition, but also upon a definite molecule condition. Hence it happens that the luminous substance obtained from burnt mother-of-pearl is better than that from burnt oyster shells; also that when slacked lime is the material employed the result differs from that obtained from aragonite, although in all four cases the resulting substances have the same chemical composition. The luminous material is scarcely at all attacked by common atmospheric influences.

The action of light upon luminous substances may be compared to striking a bell. A momentary impulse excites it and causes the bell to vibrate and give forth a tone, which tone lasts for a certain length of time, continually growing feebler, until finally it ceases entirely. So, too, the phosphorescent body. Excited by a momentary illumination, it gives out a bright light at first, which grows weaker and weaker, until at last it can only be perceived by a perfectly quiet eye in the deepest darkness, and at last comes to rest. The after illumination lasts much longer than the after sound of a bell, since the waves of light are much finer than the metallic vibrations of a ringing bell.

Most sources of light will excite phosphorescence in these substances, *e. g.*, a petroleum lamp, gas-light, and even a match. In these cases, of course the substance must be brought close to the source of light. It is excited especially by burning magnesium wire and by the electric light, but daylight is the best. Since water does not affect this substance, and since its luminosity is not due to oxidation, and hence does not need the presence of atmospheric air, it will give light under water.

An alcohol lamp flame colored yellow by common salt will not excite it, but if the alcohol flame is colored blue by copper it will. In the sun's rays, those which lie in the violet and ultra-violet are the most energetic, and they decrease in power toward the yellow. It is remarkable how the yellow and red rays destroy the effect of the opposing violet rays by extinguishing or considerably weakening the luminosity caused by these latter. Similar relations prevail when the substance is covered with colored glass. Dark blue glass, although it seems to considerably weaken the light, permits all the active rays to pass through, and at times, when daylight contains many of the red and yellow rays, a substance that has been covered with blue glass is more strongly excited than if exposed to pure daylight, because the blue glass prevents the extinguishing action of the red and yellow rays. If a surface that has been covered with phosphorescent paint is first excited, and then one-half covered with pasteboard and the other with yellow glass, the extinguishing effect of the latter will be very noticeable. The portion covered with pasteboard will continue luminous after that covered with glass is almost dark.

Heat has a peculiar effect upon the phosphorescent body after it has been isolated. It causes it to give a more intense light for a short time, but the luminosity is then of shorter duration than it otherwise would be. Heat acts here somewhat as it does on a magnet, driving out the active power, so that it requires to be recharged to set the power again in action.

It seems as if light bears the same relation to the phosphorescence of these bodies that electricity does to magnetism; hence the name of light-magnet would not be inappropriate.

The color of the light thrown out is independent of the color of the exciting rays, *i. e.*, a certain substance always glows with the same colored light whether it has been excited by a violet, blue, or colorless light. Neither does the color depend on the addition of certain metals, but seems to be the result of a definite molecular condition of the substance. The light emitted retains its color but a short time. No matter how prepared, they all get to be one color after a while—that is, white (?).

The duration of luminosity is differently stated by different authors. According to Gaedick's observation the best ones made at present time last nineteen hours, but it requires perfect darkness and an eye entirely at rest, like on waking in the morning, to detect the faint glimmer. Its luminosity is instantly destroyed by chlorine gas, also by hydrochloric and nitric acid; more slowly by sulphuric acid. It is further destroyed by substances which darken its color, hence it cannot be mixed with varnishes that contain lead and blacken; iron is also injurious, because it rusts. When used as a paint it is mixed with some adhesive substance like glue, and can then be mixed with oil, water, or a light-colored varnish, and applied repeatedly to the object that is to rendered luminous. It is well to prepare a white ground for it with chalk or zinc white mixed with a little copal, which may be dissolved in oil of turpentine.—*Oil and Paint Review.*

Rattlesnake Versus Black Snake.

On the other side of the Santa Fé water tanks yesterday, a fight occurred between a rattlesnake and a black snake. The rattlesnake was apparently on a journey, and the meeting was quite accidental. At first the rattlesnake sought to avoid a difficulty, but when the black snake pressed the matter he halted and folded his length into a coil. The black snake glided around in increasingly swift circles; the rattlesnake never changed its position—only, his head went round, following the swift movements of his foe. But the circle still diminished its size, and as the black snake drew close the rattlesnake appeared to grow confused. His rattles ceased to give out the sharp sound, and his head drooped as if vertigo was seizing him. The black snake seized, by a lightning movement, the rattler by the throat, and, winding him up in folds, the two rolled over and over together, and in a few moments the rattlesnake ceased to breathe. An examination of the dead body of the rattlesnake revealed a fracture in the spine as complete as if done by a blow with a club. The rattlesnake measured, dead, five feet and three inches.—*Fort Worth Democrat.*

A Million Years.—Here is one way of conveying to the mind some idea of what a million of years really is. Take a narrow strip of paper, an inch broad or more, and 83 ft. 4 in. in length, and stretch it along the wall of a large hall, or around the walls of an apartment somewhat over 20 feet square. Recall to memory the days of your boyhood, so as to get some adequate conception of what a period of a hundred years is. Then mark off from one of the ends of the strip one tenth of an inch. The one tenth of the inch will then represent one hundred years, and the entire length of the strip a million of years. It is well worth making the experiment, just in order to feel the striking impression that it produces on the mind. Could we stand upon the edge of a gorge, a mile and a half in depth, that had been cut out of the solid rock by a tiny stream, scarcely visible at the bottom of this fearful abyss, and were we informed that this little streamlet was able to wear off annually only one-tenth of an inch from its rocky bed, what would our conception be of the prodigious length of time that this stream must have taken to excavate the gorge? We should certainly feel startled when, on making the necessary calculations, we found that the stream had performed this enormous amount of work in something less than a million of years.—*Croll on "Climate and Time."*

The Locomotive.

PUBLISHED BY THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY.

NEW SERIES—VOL. IV. HARTFORD, CONN., MARCH, 1883. No. 3.

Dome Connections for Steam Boilers.

There are a variety of opinions among engineers as to the necessity of domes on boilers, and without discussing that question, which has already been discussed in the columns of the LOCOMOTIVE, we will consider the best method of making the connection between the base of the dome and the shell of the boiler.

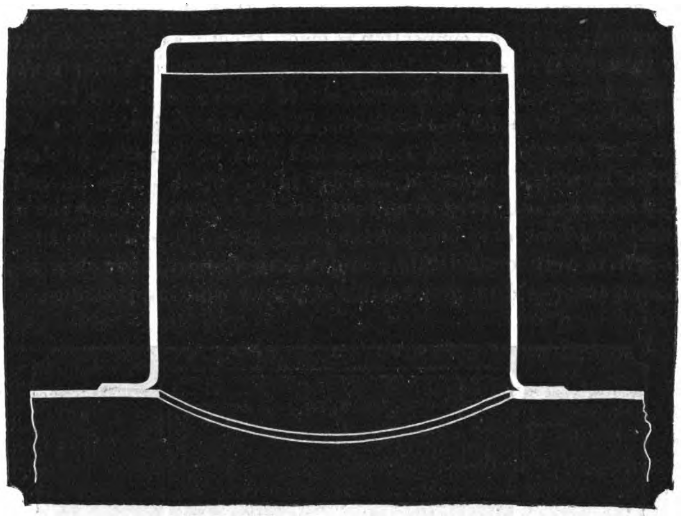


FIG. 1.

The accompanying illustrations show several methods of connection. Fig. 1 shows a very common way of constructing and attaching a dome. In this the base of the dome is simply flanged and riveted to the shell, with either a single or double row of rivets, the opening in the shell being the full size of the dome. This construction cannot be recommended in any case. For, if we examine the strains resulting from steam pressure we shall find that the effect is to separate the sides at the lowest points of the dome, B and C, Fig. 2, and depress the point D. The result of this is to bring a severe strain on the shell and flange at the points B and C, which is usually very manifest in testing a new boiler to about one-third of its calculated bursting pressure. This tendency may be resisted by putting in a stay bolt as shown in Fig. 2, or by other means to be described further on. We do not advise the use of the stay bolt in new boilers, but old ones may sometimes be very much strengthened in this manner.

Fig. 3 shows the construction which should always be adopted when the opening in the shell is the full size of the dome. The domes of locomotive boilers are usually attached in this manner and give little trouble, although subjected to very severe usage.

between the rows, so we were informed; indeed, that was the only way in which it could be done. The day preceding the explosion the boiler had been shut down under repairs, which were not completed until late in the evening, at which time the night-watchman began filling the boiler with water preparatory to getting up steam for the next day's work. The repairs referred to were about the steam-dome, and the water-level in the boiler was lowered enough to permit the boilermaker to stand upon the tubes while doing the work. In filling up again, which had to be done by hand, a man who assisted the watchman stated that he carried some three hundred pails of water, which were poured in through the man-hole until the water gauge-glass indicated that there was enough. From that time until six o'clock in the morning, the time of the explosion, the watchman was alone, and nothing is known of what transpired, except so far as it is revealed by an examination of the exploded boiler.

THE STORY OF THE WRECK.

It appeared that the initial rupture occurred about the wagon top on left-hand side of No. 1 boiler, probably about the base of the dome, for that boiler was not lifted from the ground, but was shifted around upon its base, so that it stood nearly at right-angles to its former position. The adjacent boiler, No. 2 (which had not been in use for some time previous), on the right-hand side, was moved some ten feet to the left and occupied about the same relative position when found.

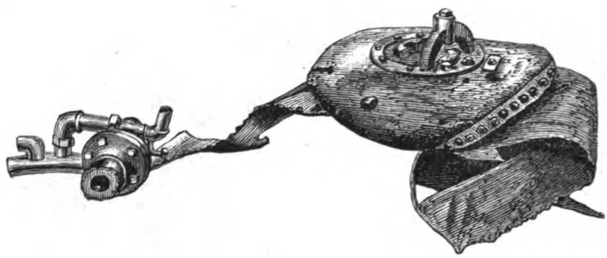


FIG. 2.

It appears probable that the initial rupture occurred about the base of the dome (Fig. 2), from the fact that that part of the boiler was stripped off and projected to a considerable height, 'and was afterwards found in a yard about 800 feet away. It is assumed that the secondary rupture was of the horizontal seam on top of boiler, releasing the side sheets of furnace, which turned downwards, straightened out, ripped and tore in the line of screw-stays on the sides, but remained attached to the base.

The crown-sheet stays (Fig. 1), it will be observed, are curved to the right and left from the centre line where they attached to the wagon-top, indicating the direction of the force exerted when the horizontal seam yielded. The tubes, with a few exceptions, pulled out of both heads, and a ring of plates containing the smoke-box and back-head (Fig. 3), which was set in a wall forming part of the masonry setting, was wrenched off and projected endwise into an adjoining room, destroying some valuable machinery; a trip-hammer lying in the path of its projection was moved about six feet from its foundation, badly broken, and a portion of the frame and cylinder remained attached to it, as shown in this figure. The bottom plate of the smoke-box was badly corroded from a leaky hand-hole plate. This ring of plates was detached from the other part of the shell through the encircling line where it was bricked into the wall, and the line of separation was as clear-cut as if done with the shears.

At time of last repairs a new steel fire-box had been put in this boiler in place of the original iron one, condemned and removed. The steel fire box was badly bulged upon the crown and also at the sides (see Fig. 1), and there were many indications that it had

been badly over-heated through lack of water, yet it did not fracture. The story of the wreck, as revealed by the distorted and battered parts of the boiler and its attachments, is quite an interesting one, for it reveals serious defects that ordinarily do not attract the attention of those owning or operating steam boilers, yet would not escape the attention of the trained boiler inspector. Of the most prominent defects were :

1st. The weakness of the shell at dome. The opening in shell under dome measured 30x30 inches, being cut out full size of the dome first put on, which it is reported ruptured under a hydrostatic proof-pressure of 150 lbs. at shop, and the builders afterwards replaced it by one of 36 inches diameter. An attempt to reinforce this weak place was made at that time or subsequently by putting a flat band of iron across the opening; but not being properly placed it had practically little if any value. The tendency of the stress upon the boiler at that place was to distend the shell which, dangerously weakened by the large dome opening, was insufficient in strength to preserve its form; in consequence it flattened, the dome was thereby distorted and gave signs of distress by leaking about the flange. This effect not being understood, it was treated simply as an ordinary leak, to be stopped in the usual way. In time the material reached the limit of its strength and rupture occurred.

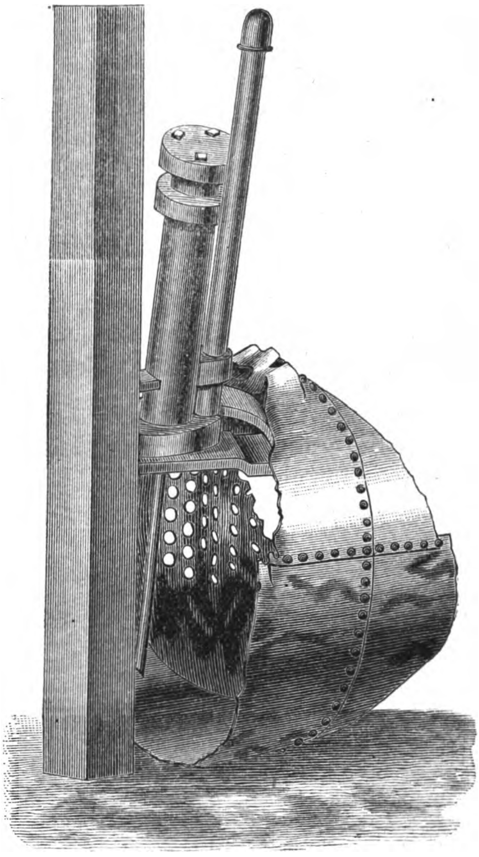


Fig. 3.

2d. The wagon-top was braced to the crown-sheet by solid crow-foot stays of one inch diameter, pitched 7″x12″ between centres; at 80 lbs. pressure, the stress upon each of these stays, supposing that they drew equally, would be 6,720 lbs., while the safe load upon a stay having the same sectional area would be 6,000x7854=4,712.4 lbs. The construction of the crow-foot attachment of the stay was such that it would be likely to spring considerably under a full load, and this, if it occurred, would increase the danger by permitting a distortion of that part of the boiler.

3d. The safe working pressure of a new boiler 54 inches in diameter, single-riveted, built of plates .289 inches thick, of unstamped iron, assumed to have a strength not exceeding 45,000 lbs., would be 80 lbs., according to the rules of the U. S. Steamboat Inspection Service, but in the case under consideration the shell of the boiler was evidently stronger than the fire-box part, through arrangement of stays and weakening effect of cutting away so much of the shell at dome, it would not safely warrant a higher pressure than 50 lbs. Recollecting the fact that for years this boiler had sustained a working pressure of from 90 to 100 pounds, the disastrous effect of this overloading is apparent, and explosion seemed inevitable.

THE IMMEDIATE CAUSE OF THE EXPLOSION.

It appears from the statement of the man who assisted in filling the boiler that a proper quantity of water was put into the boiler. It also appears that at the time of the explosion the water did not cover the crown-sheet. It is not unlikely it may have leaked out in the interval of a few hours, if it be true, as we were informed, that the check-valve on that boiler leaked badly only the day before; the water may have escaped without attracting the watchman's attention, who was inexperienced in the care of boilers; he assumed, perhaps, that the water was there in sufficient quantity, and anticipating slow work in getting up steam from cold water he forced the fires, for he told his companion when he parted from him "that he should start fires early." If fires were started early and forced as they might have been with the fuel at his command, steam would have been generated rapidly; and were the safety valve inoperative—a very common cause of explosions, but concerning which we could not satisfy ourselves in this case, owing to our inability to recover the valve—the condition of the boiler was such that it would not have required an excessive pressure of steam to explode it.

Getting up steam on a boiler or a battery of boilers is thought to be a matter of no special importance in most manufacturing establishments, and when it has to be done in the night is commonly entrusted to the watchman, whose knowledge is limited to building a fire and keeping it agoing until an engineer gets there in the morning. This is a great mistake that already has cost many lives and thousands of dollars expenditure repairing damages to property caused by their inexperience or recklessness. How many boilers have been injured by watchmen under such circumstances only those familiar with such matters can tell.

Inspectors' Reports.

APRIL, 1883.

The following is the summary of the reports of the Inspectors for the month of April last. The number of inspection trips made was 2,364, the whole number of boilers inspected 5,113, while the number of boilers thoroughly examined both internally and externally foots up 2,085, an increase of over 18 per cent. over the number inspected during the corresponding month last year. The number of boilers subjected to the hydrostatic test was 362, while 43 were condemned. The usual analysis of defects is appended.

Nature of defects.	Whole number.	Dangerous.
Cases of deposit of sediment,	415	92
Cases of incrustation and scale,	581	49
Cases of internal grooving,	24	6
Cases of internal corrosion,	152	19
Cases of external corrosion,	208	35
Broken and loose braces and stays,	32	13
Defective settings,	129	28
Furnaces out of shape,	125	17
Fractured plates,	120	62
Burned plates,	205	51
Blistered plates,	250	29
Cases of defective riveting,	311	123
Defective heads,	41	24
Leaky tubes,	252	50

Leaky seams,	134	26
Water gauges defective,	112	25
Blow-out defective,	25	6
Cases of deficiency of water,	14	9
Safety-valves overloaded,	38	21
Safety-valves defective in construction,	28	17
Pressure gauges defective,	232	34
Boilers without pressure gauges,	1	1
Total,	3,429	737

BOILER EXPLOSIONS.

APRIL, 1883.

SAW-MILL (49).—The boiler in Fred. Meyer's saw-mill, seven miles north of Warsaw, Ind., exploded April 1st, destroying the mill and machinery, but injuring no one. Loss, $1,200.

—— MILL (50).—A boiler in one of the Griffin mills, Moss Point, Miss., exploded April 3d, instantly killing Jim Cooper, colored, of New Orleans. Simon Lasky and William Brown, colored, of Mobile, were scalded and have since died. Five other colored men and one white man were seriously injured.

—— MILL (51).—The boiler attached to an engine of seventy-five horse power exploded in the factory of George Bishop, at Newbern, N. C., April 6th. The engineer, Abram Brown, and fireman Frank Emmett were killed. The house of Isaiah Wood, one hundred yards distant, was destroyed, and Mrs. Wood was, it is believed, fatally injured. Two employes in the factory named Duncan and Staubb, were hurt by the flying bricks. Half of the factory was demolished and all the houses in the vicinity were more or less damaged.

WOOD-WORKING MILL (52).—Two boilers in Hitchcock & Bradley's shaft and pole works, Ashtabula, Ohio, exploded April 12th, demolishing the building, which was a three-story brick structure, and wrecking McGuire's carriage works, adjoining. The loss is $15,000. Charles Grubham, the night watchman, whose business was to get up steam in the morning, was killed.

WOOD-WORKING MILL (53).—A boiler in the Hudson Chair Factory, Hudson, Wis., exploded April 12th, and William Poaska was burned and bruised so severely that he died at 7.30 that evening. Superintendent Fisher was struck on the head by flying debris and severely hurt. A young man named Rilley was injured slightly. The wreck was complete, and pieces of the building were carried one-quarter of a mile. Fifty men in the neighboring room escaped without injury. The casings of the boiler were torn to ribbons. Total damage about $10,000.

SAW-MILL (54).—A boiler in the saw-mill of William Marks, five miles south of North East, Pa., exploded April 14th, badly injuring five men who were standing within six feet of the boiler. The boiler was of the locomotive fire-box type, and was eighteen years old. The main part of it was thrown thirty rods, nearly straight ahead, and the fire-box twenty rods in the opposite direction. The engine was running at the time. The boiler was foaming; the amount of steam is not known, but it was probably 175 pounds. The gauge showed a pressure of 95 pounds, but it was out of repair.

SAW-MILL (55).—The boiler of Donald McCleay's planing-mill, Portland, Or., burst April 18th. W. A. Gheen, engineer, was killed, and two others wounded, not dangerously. The front of the mill was blown out.

Yarn-Mill (56).—The boiler in the yarn-mill of Rose & Scofield, Evansville, Ind., exploded April 21st, instantly killing Ferdinand Schultheis. Three sheets of the boiler were blown over three hundred feet from the building, making a wreck of the mill. The mill was isolated, and the explosion took place during the dinner hour, or the loss of life would have been greater.

Saw-Mill (57).—The boiler in the portable mill of Robert Cope, in Plainfield township, Mich., exploded April 26th. The mill was completely demolished, and the fireman, Dayton Johnson, had his skull crushed, and will probably die. The boiler was second-hand, and had been burned. Loss, $1,000.

Mine (58).—A St. Paul dispatch of the 7th instant says: The first steamer of the season arrived from Silver Islet this morning and brought the first news of a boiler explosion in a mine there in April. One man was killed and a number seriously scalded. The mine was greatly damaged.

Coating Steel with Copper.—Experiments are at present carried on in Belgium to preserve steel, and steel gun barrels in particular, by coating them thinly with copper by a process of which M. F. Weil is the inventor. Its peculiarity consists in the composition of the baths used, in which the usual and always dangerous cyanides of the alkalies are replaced by organic acids and glycerine. According to M. Weil, these baths require no renewal of organic elements, and can be used continuously when they are saturated with peroxide of copper. They possess also the advantage, owing to the property inherent in organic alkaloids of dissolving the peroxide of iron without attacking the metallic iron itself, of cleansing the steel before the commencement of the coppering process, and more perfectly than can be done mechanically. The coppering is effected by putting porous clay vessels filled with caustic soda lye, in which zinc plates have been immersed, in the basin containing the organic copper base (alkaloid) and the steel. The zinc plates are connected by a thick copper wire with the steel articles to be coated with copper. The caustic lye may be used over and over again. Should it become saturated with oxide of zinc, it is sufficient for its regeneration to treat it with sulphide of sodium, when the oxide (of zinc) will be precipitated and a by-product obtained, by which the cost of the process will be considerably reduced. The coppering process, it is said, occupies but a very short time.—*Mechanics.*

A Departure in the Enumeration of Time.—The Cleveland, Akron, and Columbus Railroad has made a new departure in the enumeration of time, called the "twenty-four-hour system." By this plan the day begins at midnight and the hours are numbered consecutively from 1 to 24. The object is to prevent mistakes in time tables, such as that of 8 a. m. being confounded with 8 p. m., by having the same hours read 8 o'clock and 16 o'clock, respectively—the distinctions a. m. and p. m. being dropped entirely. It is proposed that watches and clocks have an interior circle to show the extra figures designating the latter 12 hours of the day. It is evident that there is need of a new system of time for the moving of trains, and we shall undoubtedly have it before many years, but there is a great risk assumed in adopting any radical change that contains complications which are in the least degree puzzling to the average trainman. Railway managers will therefore make such changes with the greatest caution. The continuous enumeration of the 24 hours of the day is the simplest change from the present practice which has been suggested, and as the Cleveland, Columbus, and Akron is the first road to adopt it, the result will be watched with much interest.—*Mechanics.*

The Locomotive.

HARTFORD, JUNE, 1881.

WE call attention to the article on page 104, entitled "*Who First Successfully Applied Steam for Propelling Vessels.*" Dr. William Wood, its author, has been for years gathering the facts relating to the history of John Fitch's investigations into, and experiments with, steam as applied in this direction, and as a result gives to the public this noble tribute to his memory and worth. Born in poverty and with none to encourage his early efforts,—by singular devotion to what he believed was possible to accomplish, and by force of will under intelligent investigation, he gained the attention and endorsement of eminent men, and secured the recognition and favor of State legislatures, and finally a patent from the Federal Congress for a term of fourteen years. At this period, however, the country was poor, having just emerged from the long and terrible struggle for independence. Few men could be found that were willing to furnish the funds necessary to develop and carry out new and comparatively untried plans. Fitch was unable to secure the aid which he sought, and so this remarkable man, doomed to disappointments and discouragements, finally broke down in health and committed suicide. In looking over his autobiography it is sad to find the following record: "*The day will come when some more powerful man will get fame and riches from* MY *invention; but nobody will believe that poor John Fitch can do anything worthy of attention.*" Many an inventor has met with a similar experience on the eve of complete success. Poverty and the failure to enlist men of means in their enterprise have stood immovably in the way of progress, and their cherished plans have been doomed to bitter disappointment. Others more fortunate have taken up their plans and inventions, and profiting by their failures and successes have gone on to wealth and renown. The preparation of this portion of the life and labors of John Fitch by Dr. Wood has been to do justice to the memory of one who is almost forgotten, and who lies buried in an obscure and neglected grave on the banks of the Ohio River. The State of Connecticut would do a graceful and grateful act by placing in the rotunda or on the grounds of its beautiful capitol a statute of John Fitch.

A MOST wonderful and important application of the electric light to surgical diagnosis is described in the *Annals of Anatomy* by Dr. Roswell Park of Chicago. Jos. Leiter, a well-known instrument maker of Vienna, has succeeded in producing electrical instruments by which the interior portions of the human body may be strongly illuminated and thoroughly examined by the eye of the surgeon.

It consists of a bent tube which contains a window at one end, electric wires, and tubes for the introduction of a water circulation, by means of rubber bags, for the purpose of keeping the tube cool while the electric light is burning; also, for the introduction of water into the stomach to distend the same. The tube is introduced into the mouth and pushed down until its lower end reaches the stomach. The lower extremity of the tube is provided with a platinum wire which is made to glow under the electric current which is produced by a battery. The tube is also provided with reflectors, prisms, and lenses for directing the light through the tube.

The eye of the surgeon is applied at the upper end of the tube after it has been inserted in the stomach. The mechanism employed, by a rotating motion, enables him to examine the coatings of the stomach with ease. Similar instruments have been constructed for examining the throat, ear, and bladder. There is something novel and decidedly unpleasant in contemplating the introduction of the electric light into one's stomach, but we are getting accustomed to the surprises that science is continually forcing upon us.

Who first Successfully Applied Steam for Propelling Vessels.

[From the Hartford Times, April 19th, 1883.]

In my school-boys days it was very generally conceded that the honor belonged to Robert Fulton, and no doubt at the present time the majority of the community entertain the same opinion. When I located in South Windsor, in 1847, I often heard the old people say that John Fitch, a former resident of the town, was the first man that propelled a boat by steam. This led me to investigate the subject. The libraries of our own state, both public and private—of New York City—the state libraries of New York, New Jersey, Pennsylvania, Delaware, and Virginia, were examined by myself or by proxy. Every possible effort was taken to elucidate the subject. These investigations were pursued until 1858, when I saw a notice of the publication of the life of John Fitch. I procured the work, and found the publisher, Mr. Wescott, in his statements, compiled in a great measure from Fitch's private manuscripts, was so full and complete, and so perfectly in harmony with my investigations, that I put away my papers, supposing the facts therein contained were sufficient to give honor to whom honor is due. But from articles which I have since seen in our papers and magazines, giving credit to others who never thought of steam as a motive power for vessels until years after Fitch's success, I am led to resurrect my manuscripts in order to do justice to one who prophetically said, "The day will come when some more powerful man will get fame and riches from my invention; but nobody believes that poor John Fitch can do anything worthy of attention." The first claimant is Blasco de Garay. Thomas Gonzales, director of the Royal Archives of Simancas, in Spain, published an account of the invention of Blasco de Garay in 1826. "Blasco de Garay, a Spaniard, exhibited to the Emperor and King, Charles the Fifth, in the year 1543, an engine by which ships and vessels of the largest size could be propelled even in a calm, without the aid of oars or sails. Notwithstanding the opposition which this project encountered, the Emperor resolved that an experiment should be made, and it was made with success in the harbor of Barcelona, on the 17th of June, 1543. At its slowest rate, it moved a league an hour. Garay never publicly exposed the construction of his engine, but it was observed at the time of the experiment, that it consisted of a large caldron or vessel of boiling water, and a movable wheel attached to each side of the ship. The ship was of 200 tons burden, and was called the Trinity. The captain was Peter de Scarza. By order of Charles the Fifth, and the Prince, Philip the Second, his son, there were present at the time Henry de Toledo, the Governor, Peter Cardona, the treasurer Ravago, the vice-chancellor Francis Gralla, and many other persons of rank, and several sea-captains. The Emperor and Prince and others with them applauded the engine, and especially the expertness with which it could be tacked. The exhibition being finished, Garay took from the ship his engine, and having deposited the woodwork in the arsenal of Barcelona, kept the rest himself. * * * The above was collected from the original registers preserved in the Royal Archives at Simancas—among the public papers of Catalonia, and those of the secretary of war for the year 1543." (The above was published in the North Am. Review, vol. 23; also in a note in Spark's Am. Biography, vol. 16.)

The Hon. Edward Everett, in his address before the Essex county agricultural fair, at Danvers Plains, Mass., in the fall of 1858, reiterates this same statement. It seems to me incredible that the vessel should have been propelled by steam, long before steam was known as a motive power, and if its power had then for the first time been discovered, it is still more incredible, that with such high dignitaries on board, who for a moment would not have hesitated to furnish all necessary means to immortalize their own countrymen and nation, that they should have allowed such a wonderful invention to pass into total obscurity. And is it not remarkable, to say the least, that no notice of this discovery ever appeared in any paper, journal, or magazine, for 283 years after the experiment—not until hundreds of steamboats were in daily use in this country and Europe. Conversing with Hon. James Dixon, our senator to Congress, respecting the Spanish claimant, I expressed doubts as to the reliability of the statement, and a desire to investigate the subject. He very kindly offered to assist me, and through our minister to Spain, the arsenal at Barcelona, and the royal archives at Simancas, were examined, and all the information possible was obtained, and the conclusion arrived at was that the vessel was moved by wheels and muscular power—not by steam. Since then I saw in the Scientific American of November 20th, 1858, that John Macgregor, Esq., barrister at law, London, has been investigating the subject, and in a paper read before the London Society of Arts, says: "Some months ago I inspected two letters written in A. D. 1543, by Blasco de Garay, and now preserved in the national archives at Simancas, in Spain. These give the particulars of experiments at Malaga and Barcelona with large

vessels propelled by paddle-wheels, turned by forty men. By many authors, and for a long time it has been positively affirmed, that Blasco de Garay used a steam engine for marine propulsion, but, after careful and minute investigations at Simancas, Madrid, and Barcelona, I cannot find one particle of reliable evidence for this assertion."

There are many who claim to have conceived the idea of propelling vessels by steam, who for want of means, or faith in the discovery, never perfected their plans. I will only name some of the principal claimants.

Solomon de Caus was a man of rare mechanical ingenuity, and has through some historians been credited as discovering the force of steam and its applicability to moving powers. It is to be regretted that educated men who have the reputation of knowing what they assert, should publicly make statements, that as a matter of fact have little, if any foundation in them. In the address of Hon. Edward Everett, referred to above, he quotes from a letter of that celebrated woman, Marion de Lorme, written 1641, giving an account of her visit to the mad-house in Paris with the Marquis of Worcester. She says: "when passing the house she saw a frightful face through the bars, exclaiming 'I am not mad, I am not mad,' and have made a discovery which will enrich the kingdom that will adopt it." The guide then told her that "this poor Solomon de Caus came from Normandy, four years before, to exhibit to the King an invention by which, by the power of steam, you could move a carriage or navigate the ocean, and, in short, said the guide, there was nothing you could not do by the power of steam;" and he has written a book upon the subject, called "Moving Powers." Cardinal Richelieu, who virtually wielded the power of France, turned his back upon him. De Caus followed him from place to place, exhibiting his drawings and pressing his claims, until the Cardinal, getting out of patience, sent him to the mad-house. The Marquis of Worcester was very much interested in the book, and incorporated considerable portions of it in his work, "The Century of Inventions." "But you see," says Everett, in this recital, "How France proved herself in 1651 as Spain had proved herself in 1543, unable to take up and wield this mortal thunderbolt." Unfortunately for the statement of Mr. Everett of 1651, and of Marion de Lorme of 1641, Solomon de Caus died in 1634 or 5—the exact month is not known. I should not have referred to this man, had not his name been so publicly quoted. The simple facts are these. He comes before the public in 1612, when he was in London, in the service of the Prince of Wales. In 1615 he was at Frankfort and published "Les raisons de forces mouvantes avec divers machines tant utiles que plaisantes," etc. (The laws governing moving forces with various machines both useful and amusing, etc.)

This, I suppose, is the work referred to which the Marquis of Worcester incorporated so extensively in his book, "The Century of Inventions." The "Nouvelle Biographie Generale," which is considered authority, gives an extended notice of De Caus, and says, "that the story of his having been imprisoned 'as a fool' has no foundation in fact."

In the "Century of Inventions," written by the Marquis of Worcester in 1655 (though not published until 1663), allusion is made to an engine "which placed in vessels, ships, or boats, shall draw them up rivers, against the stream, and if need be, pass London bridge against the current at low water." The Marquis lived in the exciting times of the civil wars between Charles the First and his Parliament. Taking sides with the King, he lost all his fortune, and was imprisoned in Ireland by his adversaries, thus putting a stop to his brilliant anticipations.

Daniel Papin in 1690, conceived the idea of employing steam to propel ships by paddles. In 1708 he submitted a plan to move vessels by steam, to the Royal Society, of which he was a member, and was anxious to test his invention if the society would pay the expense. The present Sir Isaac Newton thought "the expense would be more than the society could afford to pay, although he did not doubt but that his invention might be made available for the moving of ships and galleys." It is to be regretted that the society did not assist Dr. Papin, for no doubt his inventions would have developed the power of steam and its applicability to moving forces; for, a few years afterwards, Newcomen, adopting Papin's cylinder with Savery's mode of condensation, completed the atmospheric engine. England claims the honor of first applying steam for maritime purposes, through Jonathan Hulls, who, in 1736, took out a patent for a boat to be propelled by the aid of steam. In 1737 he published a pamphlet in London, illustrative of his plan. Its title is, "A Description and Draught of a New Invented Machine for carrying Vessels or Ships out of, or into any Harbour, Port or River, against Wind or Tides." This important discovery for some reason was never carried into execution by Hulls; hence this claim of England for priority in steam navigation fails.

In 1759, M. Genevois, minister of Berne, invented a species of steam propeller, which, like the foot of a duck, would expand and make a large surface to the water when moved against it, but would fold up into a small compass when moved in an opposite direction. This looked very plausible in theory, but practically it was a failure.

In 1774, Count d'Auxiron, a French nobleman, succeeded in the construction of a steamboat which was tried upon the Seine, near Paris. It moved against the stream very slowly. He was assisted by an ingenious countryman, Perier. After several very unsatisfactory experiments the boat was given up as a failure.

In 1782, Marquis de Jouffroy constructed a steamboat, 140 feet long and 15 feet wide, to ply on the Saone, at Lyons. The boat excited considerable attention and several experiments were made with it. The dreadful disturbance which shortly broke out in France put a stop to his efforts, and for several years he was an exile. On his return, in 1796, he found the principal part of his invention adopted by Des Blancs, who had gained his information from the experiments of the Marquis. The latter appealed to the government, but Des Blancs had obtained a patent during his absence, so that he was left without redress. Neither Des Blancs nor the Marquis ever succeeded in making a success of the enterprize.

We next come to one of our own countrymen, James Rumsey, who claimed to have used steam for propelling a boat in 1784. But from all the facts and testimony given, it appears that steam was an after consideration. General Washington, who was a friend of Rumsey, in his certificate, dated September 7, 1784, says: "That James Rumsey has discovered the art of working boats by mechanism, and small manual assistance against rapid currents." Rumsey petitioned the legislature of Pennsylvania, November 26, 1784, for what now is equivalent to a patent. (During the Confederation and before the adoption of the Federal Constitution, the States generally exercised the prerogative of passing laws for the encouragement of useful inventions.) This was granted him in March 25th, 1785. At that time there was no mention made, nor any idea held up to the committee of the Pennsylvania legislature, that his boat was to be propelled by steam. This is apparent from a letter from General Washington, dated "Mount Vernon, January 31st, 1786. Sir:—If you have no cause to change your opinions respecting your *mechanical* boat, and reasons unknown to me do not exist to delay the exhibition of it, I would advise you to give it to the public as soon as it can be prepared conveniently." This shows conclusively that the mechanical boat had not been tried at that time. This boat was propelled by hand labor, and by the force of the current in working the wheels and setting poles. From the testimony of twenty-one persons who knew positively regarding the time of building Rumsey's steamboat, it appears that work was not commenced on it until 1786. It was constructed on the plan of a common lifting pump, united with a forcing apparatus worked by steam. The funnel through which the water was ejected lay along the keel, discharging at the stern. The suction pipe was placed at the bow, and the engine midships, the reaction of the water being the impelling agent. (This same plan was invented by a Frenchman, named Bernoulli, in 1753, but never put to any practical use.) The first public exhibition of Rumsey's steamboat was made at Shepardstown, Va., December 3, 1787, as certified to by Major-General Horatio Gates, the Rev. Robert Stubbs, and others. It moved at the rate of three miles an hour. I have gone into particulars in this case, as Rumsey's friends claim that he was the first man who successfully moved a boat by the power of steam. Thus far steam navigation has been of no practical value; in fact it has no existence.

I now come to the first successful claimant, JOHN FITCH, of Windsor. (Windsor then embraced what is now several towns, both on the east and west sides of the Connecticut river; Fitch's birth-place was South Windsor, near the East Hartford line.) April 15, 1785, JOHN FITCH first conceived the idea of steam as a motive power for carriages, but soon turned his attention to its application in moving vessels, and says: "I was then altogether ignorant that a steam engine had ever been invented. The propelling of a boat by steam is as new as the rowing of a boat with angels, and I claim the first thought and invention of it." It was in Cobe Scout's log shop that Fitch made his first model of a steamboat with paddle-wheels. "The model was tried on a small stream on Joseph Longstreth's meadow, about half a mile from Davisville, in Southampton township, and it realized every expectation. The machinery was made of brass, with the exception of the paddle-wheels, which were made of wood." After spending some more time to perfect the model, he exhibited it to Dr. John Ewing, provost of the University of Pennsylvania, who gave Fitch the following letter to William C. Houston, formerly a member of Congress:

PHILADELPHIA, August 20, 1785.
Dr. Sir—I have examined Fitch's machine for rowing a boat by the alternate operation of steam and the atmosphere. The application of this force to turn a wheel in the water so as to answer the purpose of oars, seems easy and natural by the machine which he proposes, and of which he has shown me a rough model.

Fitch had numerous letters of recommendation from distinguished gentlemen, who had examined his model. August 29, 1785, Fitch presented the following letter to Congress:

August 29th, 1785. Sir:—The subscriber begs leave to lay at the feet of Congress an attempt he has made to facilitate the internal Navigation of the United States, adapted especially to the waters of the Mississippi. The machine he has invented for the purpose has been examined by several Gentlemen of Learning and Ingenuity, who have given it their approbation.

On the 27th of September, 1785, Fitch presented a drawing and models of his boat to the American Philosophical Society at Philadelphia. March 18th, 1786, the State of New Jersey passed a law, giving Fitch for fourteen years, "The sole and exclusive right of constructing, making, using, and employing, or navigating, all and every species or kinds of boats, or water craft, which might be urged or impelled by the force of fire or steam, in all the creeks, rivers, etc., within the territory or jurisdiction of this State." On the 20th of July, 1786, Fitch tried experiments on a skiff with a steam engine of three-inch cylinder, which moved a screw of paddles—the endless chain, and one or two other modes, which were not satisfactory. Disheartened by the failure, and provoked by the scoffs and insults of the spectators, he went to a tavern, and says "he used considerable West India produce that evening." The next day he felt very much ashamed of himself, and in the evening retired early. Says Fitch, "about 12 o'clock at night the idea struck me about cranks and paddles for rowing of a boat, and for fear that I should forget or lose the idea, I got up about 1 o'clock, struck a light, and drew a plan. I was so excited that it was impossible to sleep. At sunrise I sought the residence of Voight (an inventive genius whom Fitch often consulted), and showed him the draught. The plan was somewhat improved by a suggestion of Voight." The experiment was made in a skiff, July 27th, 1786, and worked to the satisfaction of the projectors. The next day he wrote to his friend, Mr. Tracy Potts:

Philadelphia, July 28, 1786.—My worthy friend. This may inform you that I completed my experiments yesterday, and find that they exceed my most sanguine expectations. We let out 7 knot of Log line and had not more than half of the purchase that we shall have on a Large Boat.

Fitch having exhausted all his resources in experiments on his machinery and boats, applied to the Pennsylvania legislature for a loan of £150, and failing of securing it by a vote of 28 to 32, he applied to General Thomas Mifflin, who was then speaker of the House, for individual aid. No prophet could have foretold the future of his discovery more accurately than did Fitch in that epistle:

Honored Sir:—I am of opinion that a vessel may be carried 6, 7, or 8 miles per hour by the force of steam; and the larger the vessel the better it will answer; and am strongly inclined to believe that it will answer for sea Voyages as well as for inland Navigation, which would not only make the Mississippi as navigable as Tide water, but would make our vast Territory on those waters an inconceivable fund in the Treasury of the United States. Perhaps I should not be thought more extravigent than I already have been * * *, when I assert, that six tons of Machinery will act with as much force as ten tons of men, and should I suggest that the navigation between this (country) and Europe may be made so easy as shortly to make us the most popular Empire on Earth, it probably, at this time, would make the whole very laughable.

The State of New York granted Fitch exclusive rights to her waters for fourteen years for the purpose of steam navigation, March 19, 1787.

The State of Delaware granted the same rights, February 3, 1787.

The State of Pennsylvania granted the same rights, March 28, 1787.

The State of Virginia granted the same rights, November 7, 1787.

Fitch's second boat was built in 1786, but the machinery was not perfected until 1787. This boat was forty-five feet long, and twelve feet beam. It had six oars or paddles on each side. The engine was a twelve-inch cylinder. The trial took place upon the Delaware, at Philadelphia, August 22d, 1787. The convention to frame the Federal Constitution was in session in that city at that time, and witnessed the success of the steamboat. Fitch, in his Journal, says that nearly all the members of the Convention were present, except General Washington. They were all pleased with the experiment, and letters of congratulation upon the success of the enterprise were given by the prominent gentlemen present—Governor Randolph and Dr. Johnson, of Virginia, David Rittenhouse, Dr. John Ewing, and Professor Andrew Ellicott, of Pennsylvania. Chief-Justice Oliver Ellsworth, of Connecticut, was on board of the steamer, and says the experiment was a success.

As the speed of the boat was not satisfactory, Fitch, after much trouble and anxiety, succeeded in raising the necessary funds to build a new steamboat, 60 feet long, and 8 feet beam. After many vexatious mishaps in perfecting the machinery, everything was ready for the trial trip about the last of July. Dr. Thornton, who was deeply interested in the success of the boat, writes to a friend, July 26, 1788: "Our boat will be tried this

evening or to-morrow. Ours is moved by paddles placed at the stern, moved by a small steam engine." Fitch says in his journal, "We finally got it to work pretty well, and set out upon a journey to Burlington, twenty miles. Henry Voight, Richard Wells, Thomas Say, and several others were on board at this trial trip,"—the longest trip ever made by a steamboat at that time. At every town along the river banks they were greeted with cheers, and waving of handkerchiefs, and when within a few rods of their destination, the pipe boiler sprang a leak, and they came to anchor. The boiler was soon repaired, and the boat made several trips to Burlington and back without any accident. On the 12th of October, 1788, there were thirty passengers on board, and were taken from Philadelphia to Burlington (20 miles, up stream), in three hours and ten minutes, which fact was certified to, by Andrew Ellicott, Richard Chase, John Poor, and John Ely. This speed did not satisfy Fitch, or those who had a pecuniary interest in the enterprise. It was determined to build a new boat with larger machinery—the cylinder to be eighteen instead of twelve inches in diameter. Various alterations and improvements were made in the machinery before satisfactory speed was attained. On the 16th of April, 1790, a trial trip was made, and, says Fitch, "although the wind blew very fresh at the northeast, we reigned Lord High Admirals of the Delaware, and no boat in the river could hold its way with us, but all fell astern, although several sail-boats which were very light, and heavy sails that brought their gunnales well down to the water, came out to try us."

Several equally satisfactory trips were made with members of the company and invited guests; and Fitch elated with his success, exclaims, "Thus has been effected by little Johnny Fitch and Harry Voight, one of the greatest and most useful arts that has ever been introduced into the world; and although the world and my country does not thank me for it, yet it gives me heartfelt satisfaction."

On the 16th of June (1790) Governor Thomas Mifflin and the Supreme Executive Council were passengers on this boat, and were so highly pleased that they presented the steamboat company with a suit of flags, the cost of which was, £5 6s. 11d. The speed of the boat was eight miles an hour. It afterwards run ninety miles one day.

This boat was now run as a regular passenger boat between Philadelphia and Burlington. The two papers published in Philadelphia, the *Pennsylvania Packet* and the *Federal Gazette*, gave notices of the days and time of sailing:

The steamboat is now ready to take passengers, and is intended to set off from Arch street Ferry, in Philadelphia, every Monday, Wednesday and Friday, for Burlington, Bristol, Bordentown and Trenton, to return on Tuesday, Thursday, and Saturday.—*Pennsylvania Packet*, June 15, 1790.

The same notice was published in the Federal Gazette, June 14th, 17th, 19th, 22d, and 24th, 1790. In the New York Magazine is an extract from a letter dated August 13, 1790—Fitch's steamboat really performs to a charm.

It is estimated that the boat must have gone at least two or three thousand miles that summer carrying passengers. Was this not a success? The great problem of steam navigation was now practically demonstrated.

Wishing now a boat large enough to carry freight as well as passengers, the new company was consolidated with the old, and another boat was contracted for—the Perseverance—with the intention of sending it to New Orleans, for the navigation of the Mississippi. It was hoped that it would be finished in time to save the benefit of the Virginia law. (The legislature of Virginia November 7, 1787, passed a law securing Fitch's rights in the steamboat for fourteen years, conditioned, "that it should be void at the expiration of three years unless the said John Fitch shall then have in use on some river of this commonwealth, boats or craft of at least twenty tons burden, navigated by steam.") The great value of the Virginia law, was, that it gave Fitch the exclusive right of navigating the Ohio river and its tributaries with the steamboat. In this, the company were disappointed. The boat and machinery were nearly completed, when a violent storm arose, causing it to break from its moorings, and it was blown upon Petty's Island, in the Delaware, opposite of the upper part of Philadelphia. The tide being unusually high, the boat was driven so far upon the land that it was impossible to get it off in season to avail themselves of the benefits of the Virginia law. The stockholders became discouraged and refused to furnish any more funds, and Fitch having exhausted all his resources, the boat was abandoned and remained for four years without any change, and was advertised for sale at auction August 18, 1795. April 23, 1791, Fitch applied to the Federal Congress for a patent. August 26th, 1791: "Whereupon ordered, that letters patent be granted to the said John Fitch for his aforesaid inventions for the term of fourteen years."

This document is signed by General Washington, and by the Commissioners, Thomas Jefferson, General Henry Knox, and John Randolph.

In 1793, Fitch went to France, at the solicitation of our Consul at L'Orient, Aaron Vail, to build a steamboat. Arriving there at the time of the Revolutionary troubles he could not obtain any pecuniary assistance. Depositing his papers and specifications in the hands of Mr. Vail, he went to England, remaining in London for a time with his friend, Mr. Leslie, formerly of Philadelphia. In 1794, he returned to the United States, working his passage as a common sailor. He found his way to East Windsor, now South Windsor, to the house of his sister, Mrs. Timothy King, and to the house of his daughter Lucy, Mrs. Kilbourne. After remaining some two years with his sister, he starts off again on his steamboat enterprise. In 1796, he constructs a steamboat out of a ship's yawl. The boat was moved by a screw propeller on a large pond of fresh water in the city of New York, called the Collect. It was afterwards filled, and embraces the ground on which stand the Tombs and other adjacent buildings. In the spring of 1798, Fitch built a model steamboat three feet long, at Bardstown, Kentucky, which was tried upon a small stream near that town.

Some time between the 25th of June and 18th of July, this remarkable man, broken down with misfortunes, disappointments, and discouragements, committed suicide. (His will was made June 25th and admitted to probate July 18th.) His remains lie unhonored, in Bardstown, with a rough stone, without inscription, to mark his resting-place. I have only given the steamboat experience of John Fitch, but hope at no distant day to give his life history.

I will now examine the merits of later claimants. In 1788 Patrick Miller constructed a boat and William Symington made an engine for it, and on the 14th of October, 1788, it was moved by steam in the lake of Dalswinton, in the presence of several spectators. This did not answer their expectations, and the next year (1789) Mr. Miller had a twelve-horse engine made and fixed to his double-bottomed boat, which was tried on the Clyde and Forth canal, with success. This was England's first successful steamboat experiment. Symington continued his experiments, under the patronage of Lord Dundas, and in March, 1802, two vessels of 70 tons burden each were towed by the steamboat, Charlotte Dundas, 19½ miles in six hours, against very strong head wind. The English declare that this was the first practical steamboat experiment. Fitch, twelve years prior to that, was carrying passengers regularly, according to advertisements, eight miles an hour. Was not that practical?

A writer in the Boston Recorder of September 23, 1858, in an interesting article on steam navigation, gives Captain Samuel Morey, of Orford, N. H., the credit of being the first man to propel a boat by steam:

> The astonishing sight of this man ascending the Connecticut river between Orford and Fairlee, in a little boat just large enough to contain himself, the rude machinery connected with the steam-boiler, and a handful of wood for the fire was witnessed by the writer in his boyhood.

I have several times since the publication of the above article seen notices in other papers claiming priority for Morey. The writers evidently were not aware, that Fitch, several years prior to that, was making regular trips on the Delaware with his steamboat. Captain Morey was an original thinker and inventor, commencing his experiments with his little steamer on the Connecticut as early as 1790. After working three years in perfecting his machinery, he in the summer of 1794 propelled a small steamer from Hartford to New York at the rate of five miles an hour. Chancellor Livingston, Judge Livingston, Edward Livingston, and John Stevens went with him from New York to Greenwich. From this time to the time of Fulton's experiments there were many steamboats constructed by different individuals; prominent among them are, Oliver Evans, Nicholas I. Rooseveldt, and John Cox Stevens. To Stevens is due the credit of making the first maritime voyage. He went with his steamer, the Phœnix, from New York to Philadelphia in June, 1808. Rooseveldt built the first steamboat, the New Orleans, that navigated the Ohio and Mississippi, in 1811.

The next claimant, and one who is very generally accorded the honor of first practically demonstrating the application of steam for moving vessels, is Robert Fulton. Only a short time has elapsed (Febuary 26, 1883) since a statue of Robert Fulton was erected in the National Hall of Statuary in the Capitol by Pennsylvania, in honor of the discovery. It was not until 1803 that Fulton, with the assistance of Robert R. Livingston, our minister to France, made his experiment with a steamboat on the Seine, at Paris, which was not a success. Three years later, he commenced building the Claremont, at New York, in the shipyard of Charles Browne. It was not completed until August, 1807. This boat was a success, but did not equal the speed of Fitch's boat of 1790 by three miles an hour. Fulton lived in Philadelphia in 1785 and 1786, the time Fitch was making his steamboat experiments in that city, and when he was petitioning Congress for assistance, and the States of Virginia, Maryland, Pennsylvania, Delaware, and New Jersey for exclusive

rights to their waters for steam navigation, and when it was in July, 1786, that Fitch made a successful public trial of his skiff steamboat on the Delaware, can it for a moment be doubted that Fulton, with his inquisitive mind, was not fully aware of Fitch's inventions? This was more than twenty years before Fulton made his experiments on the Hudson. Some time in 1786, Fulton went to England and spent several years in the family of Mr. West, perfecting himself in the art of painting. After leaving that family, he spent two years in Devonshire, as a painter, and while there became acquainted with the Duke of Bridgewater, famous for his canals, and Lord Stanhope, a lover of mechanics. Owing probably to their influence, Fulton first turned his attention to canals and steam navigation. He then went to France, and spent seven years in Paris. While there, he visited Mr. Vail, with whom Fitch had entrusted his drawings and specifications pertaining to his steamboat, and, Mr. Vail says, "*I lent Mr. Fulton of Paris all the specifications and drawings of Mr. Fitch, and they remained in his possession several months.*" According to the affidavits made by Robert Weir and Jacob Perkins, Mr. Fulton in 1801 visited England, and was on board Symington's boat, on the Forth and Clyde canal. To gratify him, the boat was propelled by steam four miles and back, at the rate of six miles an hour. *Fulton took drawings of the machinery.* Chancellor Livingston, who was aiding Fulton in his steamboat projects, was a passenger on Fitch's boat on the Collect, and was also a passenger on Morey's boat from New York to Greenwich, and no doubt had seen the steamboat experiments of Stevens and Rooseveldt on the Hudson. With the drawings and specifications of Fitch, with the drawings and observations on board of Symington's boat, with the observations of Livingston on Fitch's and Morey's boat, I would ask, to what discovery or invention pertaining to steamboats is Fulton entitled? One writer very justly remarks, "*If the inventions of others which Fulton has copied were removed from his boat nothing would be left but the hull.*" In 1817, the original patents, drafts, specifications, and models, of Fitch and Fulton were exhibited before a committee of the New York legislature, raised upon the petition of Governor Ogden of New Jersey. Witnesses were examined, and able counsel employed. Fulton and Livingston were represented by Cadwalader D. Colden and Thomas Addis Emmet, Fitch by Samuel A. Southard, Joseph Hopkinson, and Colonel Ogden. Certificates of Dr. Rittenhouse, Andrew Ellicott, Oliver Evans and John Ewing were produced, stating the performance of Fitch's steamboat. General Bloomfield testified, that he "had been a passenger on board Fitch's boat on the Delaware in 1787 and 1788, and regarded the experiment as successful." The committee after much deliberation reported to the legislature that "*The steamboats built by Livingston and Fulton were in substance the invention patented to John Fitch in* 1791, *and Fitch during the the term of his patent had the exclusive right to use the same in the United States.*" What stronger evidence can any one ask than the above, to substantiate the claim of Fitch over Fulton to priority in steam navigation?

Fulton, when he commenced his experiments, had the advantage of the models, specifications, drawings, and plans of Fitch—had made a successful trip on Symington's and Miller's steamboat and taken drawings of the machinery—had the benefit of Livingston's observations on Fitch's and Morey's boats—had his engine built in England by James Watts—had influential and wealthy friends to assist him. Fitch, when he commenced his experiments, was not aware that there was a steam-engine in the world—made his own engine with the assistance of common blacksmiths—had to experiment as he progressed to know the relative position and power of the parts—was poor, but by selling lands in Kentucky, which he acquired by surveying, and by limited assistance from friends, he surmounted incredible hardships, misfortunes, and discouragements, and overcame every obstacle, and demonstrated to the world the first successful steamboat enterprise. To-day Fulton's memory is honored by a statue in the Capitol, from Pennsylvania. Fitch lies in a lone grave at Bardstown, Kentucky, with a rough stone without inscription to mark his resting place. Let the nation honor the true inventor, John Fitch, by erecting some fitting monument to perpetuate the memory of one of her most useful inventors.

We are greatly indebted to Dr. Thornton, Whittlesey, and Wescott for the services they have rendered in bringing before the public the merits of John Fitch.

WILLIAM WOOD.

East Windsor Hill, March 12, 1883.

The Landed Proprietors of Great Britain.

It is a startling fact, and one which must fill the minds of reflecting Englishmen with grave concern, that more than one-half the land in the United Kingdom is held by one-twelve-thousandth of the population. That is to say, 2,238 individuals, out of a population of 28,000,000, monopolize forty millions out of the seventy-two millions acres, which comprise the territory of the two islands. It is still more startling that more than one-eighth of the territory, comprising 9,374,000 acres, is held by forty-four persons, not one of whom owns less than 100,000 acres, and two of whom—Lord Middleton and the Duke of Sutherland—possesses over a million acres each. The following table, prepared from the analysis of landholders in the "Financial Almanack," shows how this property is distributed and who are the great landed proprietors of the kingdom:

Proprietors.	Acres.	Proprietors.	Acres.
Duke of Argyll,	175,000	Marquis of Lansdowne,	135,000
Duke of Athole,	194,000	Lord Leconfield,	110,000
Evan Bailie,	165,000	Lord Lovat,	161,000
Rich. Berridge,	170,000	Lord Macdonald,	129,000
Marquis of Breadalbane,	438,000	A. E. MacIntosh,	124,000
Duke of Buccleugh,	459,000	Sir K. S. Mackenzie,	164,000
Marquis of Bute,	116,000	Norman Macleod,	143,000
Donald Cameron,	126,000	Alex. Matheson,	220,000
Earl of Cawdor,	101,000	Sir J. Matheson,	406,000
Jas. S. Chisholm,	113,000	Lord Middleton,	1,005,000
Duke of Cleveland,	102,000	Duke of Montrose,	103,000
Marquis of Conygham,	173,000	Duke of Northumberland,	186,000
Earl of Dalhousie,	138,000	Duke of Portland,	161,000
Duke of Devonshire,	193,000	Duke of Richmond,	286,000
Marquis of Downshire,	123,000	Sir C. W. A. Ross,	166,000
J. R. Farquharson,	109,000	Earl of Seafield,	305,000
Earl of Fife,	257,000	Marquis of Sligo,	122,000
Earl Fitzwilliam,	114,000	Duke of Sutherland,	1,208,000
J. Gordon,	112,000	Duchess of Sutherland,	149,000
Sir G. McP. Grant,	127,000	Marquis of Waterford,	109,000
Duke of Hamilton,	157,000	Lady Willoughby de Eresby,	132,000
Countess of Home,	103,000		
Lord Kenmare,	105,000	Forty-four persons,	9,374,000

In the House of Lords the property interest is, of course, paramount, 438 out of 505 peers being landowners to the extent of 14,250,000 acres; while in the House of Commons there are 194 proprietors, owning 2,121,000 acres, besides 66 sons and heirs of land-holding peers. Taking both houses together, the land-holding members of Parliament are in a majority of 120; and since they own nearly a quarter of all the land in the kingdom, it can hardly be expected that they will pass any legislation interfering materially with the existing land laws, or operating to their own disadvantage.—*N. Y. Observer.*

A German has invented a safe that, on its lock being tampered with, throws open its doors, seizes and drags and locks in the burglar, and handcuffs and holds him in readiness to be conducted to the police court in the morning. The Yankee is experimenting with a set of books for the use of county officers, which, as soon as a fraudulent entry is made in them, will, by means of a clever electrical contrivance, sound an alarm on the court-house bell.

The Locomotive.

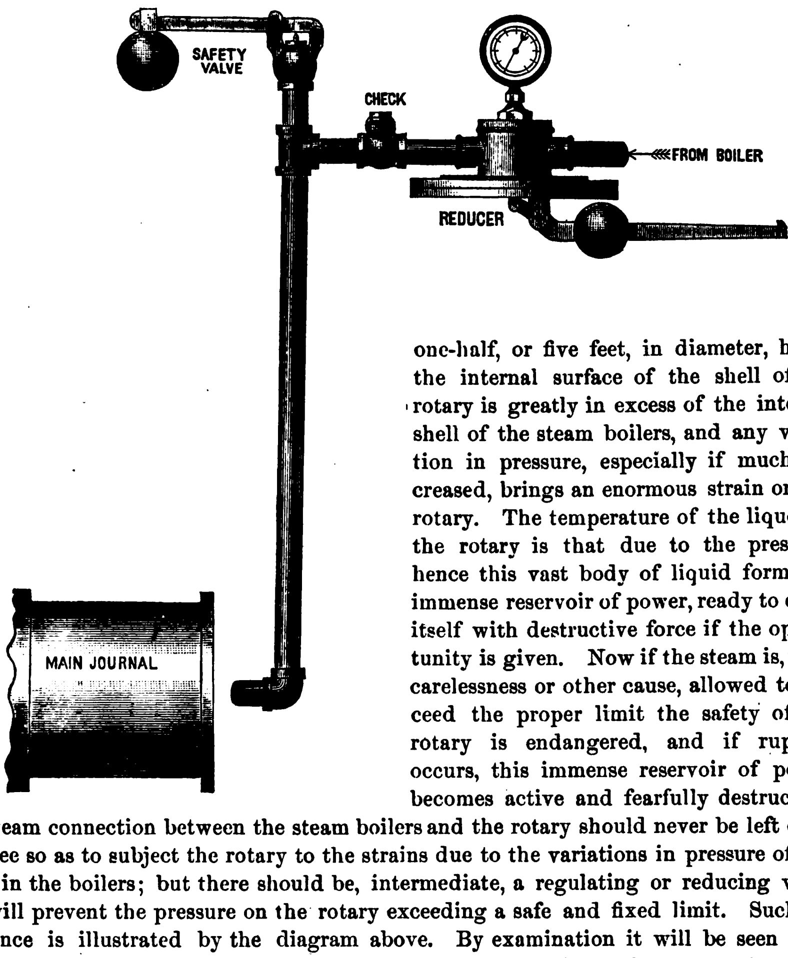
PUBLISHED BY THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY.

NEW SERIES—VOL. IV. HARTFORD, CONN., JULY, 1883. No. 7.

How to Regulate the Pressure in a Rotary Bleach.

The explosion of a rotary bleach is usually attended with great destruction.

The inquiry arises why should such a boiler explode, making such havoc, when there is no fire used in connection with it? It will be understood that these boilers are filled with the material to be bleached or treated, and the liquor used in the process. This mass is heated by steam direct from the steam boilers. The bleach boilers are usually six or seven feet in diameter, while the boilers supplying the steam are only four and



one-half, or five feet, in diameter, hence the internal surface of the shell of the rotary is greatly in excess of the internal shell of the steam boilers, and any variation in pressure, especially if much increased, brings an enormous strain on the rotary. The temperature of the liquor in the rotary is that due to the pressure, hence this vast body of liquid forms an immense reservoir of power, ready to exert itself with destructive force if the opportunity is given. Now if the steam is, from carelessness or other cause, allowed to exceed the proper limit the safety of the rotary is endangered, and if rupture occurs, this immense reservoir of power becomes active and fearfully destructive. The steam connection between the steam boilers and the rotary should never be left open and free so as to subject the rotary to the strains due to the variations in pressure of the steam in the boilers; but there should be, intermediate, a regulating or reducing valve that will prevent the pressure on the rotary exceeding a safe and fixed limit. Such an appliance is illustrated by the diagram above. By examination it will be seen that the steam-pipe from the boiler connects first with a reducing valve or regulator, on

which is a steam gauge. Following is a swing check valve, which prevents any liquor in the rotary from running back into the reducer. On the top of the vertical pipe is a safety valve to relieve the rotary of any excess of pressure should the reducer from any cause become inoperative. With the reducer and safety valve properly adjusted, any required and safe pressure can be maintained on the rotary, and the pressure to which the appliance is adjusted cannot be exceeded. We ask the careful attention of all paper manufacturers to this device. We believe it will overcome and prevent the danger attending the use of rotaries as usually fitted up. We prepared the device for a prominent paper manufacturer, who expresses great satisfaction with its operation. There is no patent on it; any steam fitter can put it up. Care however should be used in having the reducer properly adjusted to the rotary to which it is to be attached.

Inspectors' Reports.

MAY, 1883.

The summary of the work of the Inspectors for the month of May last shows a most satisfactory state of affairs, in a business sense, but a pretty unsatisfactory state from an engineering or mechanical standpoint. The whole number of inspection trips made foots up 2,463, during which 5,188 boilers were visited. Of this number 2,333 were thoroughly examined, both externally and internally, and 313 others were subjected to the hydrostatic test. The number of boilers condemned was 23. The total number of defects found which were considered of a sufficiently serious nature to be reported was 3,532, of which 507, or 14 per cent. were dangerous. The following table shows the defects in detail.

Nature of defects.	Whole number.	Dangerous.
Cases of deposit of sediment,	499	35
Cases of incrustation and scale,	588	39
Cases of internal grooving,	22	10
Cases of internal corrosion,	92	25
Cases of external corrosion,	148	35
Broken and loose braces and stays,	50	12
Defective settings,	111	17
Furnaces out of shape,	156	15
Fractured plates,	108	40
Burned plates,	159	28
Blistered plates,	347	37
Cases of defective riveting,	268	72
Defective heads,	41	13
Leaky tubes,	469	15
Leaky seams,	174	24
Water gauges defective,	62	19
Blow-out defective,	18	4
Cases of deficiency of water,	5	3
Safety-valves overloaded,	25	7
Safety-valves defective in construction,	17	10
Pressure gauges defective,	168	42
Boilers without pressure gauges,	5	5
Total,	3,532	507

BOILER EXPLOSIONS.

MONTH OF MAY, 1883.

Oil Well (59.)—Harry Hope was instantly killed at 1 o'clock May 3d, by a boiler explosion on the Smith farm, one mile from Franklin, Pa. The boiler was a large stationary one of 40-horse power, and furnished steam for over twenty wells. Two derricks were torn down and property damaged on all sides. Hope's body was carried through the air for 250 feet over the tree tops.

Saw Mill (60.)—The boiler in Clapp & Lyttle's mill, Winamac, Ind., exploded on May 8th, instantly killing Joseph Lyttle, and fatally wounding Anderson Clapp.

Saw Mill (61.)—At 5.30 p. m., May 10th, a terrific boiler explosion occurred at the saw mill of A. W. Kent & Co., in Corry, Pa. The boiler was about forty-horse power, four-foot shell, twelve feet long, and has been in use nearly fifteen years. One half was blown four hundred feet away, and the other a distance of one hundred and fifty feet. Brick and rubbish was thrown for hundreds of feet around. Nelson Dimmick, the fireman, was scalded on the breast, stomach, and arms, besides being badly cut about the head. His little son, who was with him at the time, was slightly injured.

Saw Mill (62.)—A terrific saw mill boiler explosion occurred May 11th, on the farm of John Guyer, ten miles southwest of Goshen, Ind. Three men were killed, Levi Guyer, Henry Acker, and Willis Brundage. Henry Knizely, John and Joseph Guyer were so badly scalded that they cannot recover. The boiler had been considered unsafe for years, but the exact cause of the explosion is not known. The boiler was found 500 feet away.

Saw Mill (63.)—The boiler in Merrick's & Gibbs' saw mill, Green Bay, Mich., exploded May 14th. The rear part of the boiler house was demolished. A young man employed about the mill was severely but not fatally injured by the escaping steam.

Saw Mill (64.)—The boiler in the Bourbon, Ind., boat-oar factory exploded May 20th. Loss, $1,000. No one was injured.

Paper Mill (65.)—A terrific boiler explosion occurred May 21st, at the new Wolverine Paper Mill in the eastern part of Detroit, Mich. The walls of the building were blown down, and the shock of the explosion was felt many blocks away. William Thompson, engineer, a one-armed man, was undoubtedly instantly killed. Peter Frank, fireman, was fatally injured. The mill was new, erected only a few months ago by the Wolverine Car Roofing and Manufacturing Company, at a cost of $90,000. The loss is estimated at between $50,000 and $60,000. Insurance, $30,000.

Steamer (66.)—The steamer Pilot, running in opposition to the San Francisco and North Pacific railway, was blown up and destroyed near Petaluma Creek, May 24th. The captain, pilot, and five others are the only ones known to have been saved, and these were all injured. Eight persons are known to be killed, and the number of missing is unknown, as the names of passengers were not recorded at the place of departure. One family of twelve persons is reported to have been on board, and it is believed that many perished with the vessel. Later dispatches state that Mr. Matthews, late of Sonoma Mountain, on the way to Arizona, lost four children and another will die. H. Egler, who had just purchased property here, was killed. Mrs. G. P. McNear was found about a mile and a half from the scene of the explosion. She was standing in the mud, still alive, but unconscious. She was immediately removed to Lakeville, but died a few minutes after her arrival.

Brickyard (67.)—A boiler in the brickyard of Bly & Granbary, Bismarck, Dak., exploded, May 24th, instantly killing John Hasson, fireman, and James Oulette, carpenter;

fatally injuring James Oulette, and badly scalding Daniel Lyons. Two others were slightly injured. Damage, $10,000.

Chemical Works (68.)—About 10.30 o'clock A. M., May 25th, the boiler in the Pan Handle Chemical Works, just opposite Steubenville, Ohio, exploded. Three sheets of iron were torn off, and the boiler lifted and thrown eastwardly forty feet, across the county road. The boiler house was badly wrecked. The engineer's dwelling, near by, was much damaged by steam and water and by fragments of the boiler house. One stick of timber struck and carried in the kitchen door, just missing a hired woman—a narrow escape from death. The loss is $1,500 to $2,000. No one hurt.

Locomotive (69.)—On the morning of May 25th, the engine of a work train on the Chesapeake & Ohio road exploded its boiler while at work removing a wreck at Callahan, Va. The front end of the boiler was blown out, the engine completely wrecked, and six men of the wrecking gang injured. Some pieces of the boiler were thrown half a mile. The engine was 12 years old.

Saw Mill (70.)—The boiler in a saw mill at Waterford, Spencer county, Ky., exploded May 25th, fatally wounding several workmen, and instantly killing John Purcell, the owner of the mill.

Saw Mill (71.)—A terrible boiler explosion occurred one and one-half miles east of Leon station, Ohio, May 25th. From some unknown cause the boiler in the saw mill of E. C. Chandler exploded with terrific force and fatal effect. The building was torn to pieces. Nelson Johnson was instantly killed and M. Lewes and James Lewes were severely hurt, how seriously cannot now be told. The mill had been running only a little over three weeks. The loss will be in the neighborhood of $1,000.

Saw Mill (72.)—A boiler in Harris' mill, eight miles northwest of Mattoon, Ills., exploded May 26th, killing James Johnson, and probably fatally injuring Robert Davis and a man named Lomon. The boiler was split in two and the ends blown five hundred yards apart. Cause not known.

Saw Mill (73.)—The boiler of a saw mill at Champaign, Ills., exploded May 26th, killing two of the employes. The mill was reduced to kindling-wood.

Flour Mill (74.)—The boiler in the Royal Gem Flouring Mill at Staunton, Ill., exploded May 30th, and damaged the mill about $10,000. Engineer Davis was somewhat injured, but nobody else was hurt.

Saw Mill (75.)—A boiler exploded at the saw mill of Blackshear & Snyder, in the northwestern part of the parish of Opelousas, La., May 31st, killing two men, and badly wounding four.

The Hartford Steam Boiler Inspection and Insurance Company.

This company has now attained its seventeenth year, and its name and reputation are well established among the users of steam throughout the country. Its success has been due to the vigorous and intelligent manner in which its affairs have been managed and to its fidelity to the one business of the construction, care, and management of steam boilers, with a view to greater economy and safety in their use. Its advice is largely sought in the laying out of boiler houses, chimneys, and boiler plants. In connection with its office is a draughting room, chemical laboratory, and appliances and facilities for experimenting upon the strength and structure of iron and steel. It has some 18,000 boilers under its care, and employs forty-two (42) trained and experienced engineers, who are constantly engaged examining this large number of boilers. It is not hampered by the sale of any patent boiler or boiler attachments, and this particular feature has no doubt done much to establish it in the confidence of the manufacturing community. It is doing an important work and has well earned its present high standing among those who use steam power.—*Independent.*

The Locomotive.

HARTFORD, JULY, 1883.

Quality of Iron for Steam Boilers.

There is so much discussion and controversy in regard to the real value of the different grades of iron offered in the market for boiler plates, that we have felt compelled to investigate the subject in order to ascertain what the brands used at present mean, and what quality of iron is indicated by them. We find that the brands as formerly used were:

C. H. No. 1, flange,	C. No. 1,
C. H. No. 1, shell,	Tank.

Some manufacturers were not satisfied with these brands because they did not indicate the true character of the iron, and boiler users were often deceived by having an inferior iron palmed off upon them by boiler-makers, when they supposed they were securing a first-class article. The brands were subsequently changed, and the following are those used by most, if not all the prominent iron manufacturers in the country:

C. H. No. 1, flange,	Refined,
C. H. No. 1, fire-box,	Tank.
Shell,	

If these brands are honestly used the quality indicated is as follows, viz.: C. H. No. 1, FLANGE, and C. H. No. 1, FIRE-BOX, are strictly charcoal iron. SHELL has only a thin cover, or outer skin of charcoal iron. REFINED has no charcoal iron in it, but is simply refined from the pig. The pigs are selected with reference to the quantity of carbon which they contain. They are divided into *foundry* and *forge* pigs. Those containing the least carbon being selected for conversion into malleable, or wrought iron. The process of refining need not be described here. From the refinery the iron is usually run out into large moulds, and then broken up into what is technically distinguished as "*plate metal.*" Now the term "refined" iron is very indefinite, and means anything from "muck bar" to that which has been through several processes. The value of charcoal pig-iron, and charcoal blooms, is owing to their being produced with a fuel that is free from impurities, and while other irons can be purified it can only be done at expense and loss, and the danger is that in some cases at least it will be only purified sufficiently to "pass muster," and sell. The brand of "refined" iron in the market is often recommended as a superior article, because it is "refined," and the purchaser is led to believe that it is something unusually good.

Another test of quality is this; the price of refined iron at the time of our inquiry was 1¼ cents per pound less than the price of C. H. No. 1, Flange. The prices were, "*Refined,*" 3¼ cents per pound; *C. H. No.* 1, *Flange*, 4½ cents per pound. Questions relative to the quality of boiler plate are frequently asked us, and we take this way of answering them. We believe in the best material for boilers and always recommend it. We know that there is sharp competition in the business and that the margin of profit is often very narrow. But the purchaser should know what he is buying and be willing to pay a fair price for a first-class article. The purchaser is often as much at fault as the boiler-maker, by trying to get a first-class article for less than its cost. We know all reputable boiler-makers would prefer to use the best material, and get a fair price for their work, and some will not make estimates if inferior material is called for.

Associations of Stationary Engineers.

Considerable interest is being manifested in various localities in organizing associations of stationary engineers.

This work has been encouraged and greatly advanced through the efforts of President Cozzens, of the National Association.

The object is to bring stationary engineers, in the various cities and manufacturing centers, together for mutual improvement.

Under proper management, these associations should be productive of great good, not only to the engineers themselves, but to their employers as well. It gives the members a good opportunity to compare notes and experiences. Each will ascertain what others are doing in the same field. It is the plan in these organizations to have a suitable room, well and conveniently furnished. The tables are to be supplied with mechanical papers, and such books will be gathered from time to time as bear upon mechanical matters.

Now all this is in the right direction. It is improving and elevating. It furnishes a pleasant retreat for the engineer when his daily work is done. It should be remembered that some of the most eminent mechanical engineers which the world has known have begun life at the foot of the ladder, and it is possible for any young engineer, by reading and studying, and giving careful attention to the details of his work, to become eminent.

Such organizations should set their standard high. Drinking and swearing should not for one moment be tolerated. Character has much to do with a man's success. Mechanical ability alone will not secure the best and highest results. Good moral character, combined with ability, will be rewarded sooner or later, and these organizations can be made very effective and influential in developing in their members the best results, mechanically and morally. They should not be degraded into *trade unions*, for that would invite the hostility of many whose influence and aid will be valuable.

With the right spirit in the leaders and managers, we can see incalculable good for every member; and we would encourage those engaged in organizing such associations with the hope and expectation that their influence will be elevating and improving.

Valuable Library Destroyed.

In his book, "The War between Peru and Chili," Clements Markham states that the work of ruin carried on by the Chilians in Peru, in accordance with the policy of their goverment, is continuous and most monstrous. The National Library, the best in South America, containing more than 300,000 volumes, and that of the University of St. Mark, in its different branches of jurisprudence, medicine, political economy, mineralogy, chemistry, and *belles-lettres*, have all been pillaged by Chilian officials to such an extent that not a single book remains, while the book-cases have been broken up for packing-cases. They also stole and shipped off for Chili the instruments belonging to the astronomical observatory; the machinery, laboratories, and apparatus of the Medical College, and those for teaching arts and industries; and, as if these disgracceful acts were not sufficiently scandalous, the buildings of the university, of the library, and of the colleges, are used for barracks and stables. But this is not all; there are other deeds which rival, if they do not surpass, the devastations of Alaric and of Tamerlane. The national archives contained numerous documents, some of them dating from the conquest of Peru, and the foundation of Lima by Pizarro. They have been pillaged, and these inestimable records have been sold by weight as waste paper. The gallery of portraits of distinguished historical personages, of the Incas, and of all the Spanish

viceroys from Pizarro to Pezuela, has been destroyed. The pictures were torn down, and served as material of which the soldiers made tents in the barrack-yards. The promenades, public offices, museum, have been despoiled of all objects of art, and of every article intended for use or for amusement. Pictures, statues, bronzes, marble seats, fountains—in a word, whatever was movable has been stolen and carried off to Chili. A similar fate has overtaken the municipal schools of primary instruction, which the Chilians have closed in order to seize their endowments.

Weak Manholes.

The success of the horizontal tubular boiler in our large cities has led to its trial and successful employment in many other localities hitherto deemed unfitted for tubular boilers, owing to the nature of their feed waters. In the old style construction, with staggered tubes and as many of them as could possibly be crowded into the allotted space, there was but one way to remove scale properly, viz.: take out the tubes, which was objectionable on account of the loss of time required in work of removal, cleaning off, piecing out and replacing the tubes, with generally an additional outlay for some new tubes to replace those burned or worn out.

In the tubular boiler in its newer form, Fig. 1, specially adapted for bad waters, several of the lower rows of tubes are left out, which affords a clear space of some fifteen inches between bottom row of tubes and bottom shell of boiler at its deepest point. A manhole in front head underneath the tubes affords easy access to the interior of the boiler, facilitates the work of cleaning and removal of scale and deposit, and further adds to the boiler's efficiency by improving its circulation. The design in Fig. 1 is not shown nor recommended as the best disposition that may be made of the tubes to accomplish the object. Fig. 2 will be found a better illustration of our best practice.

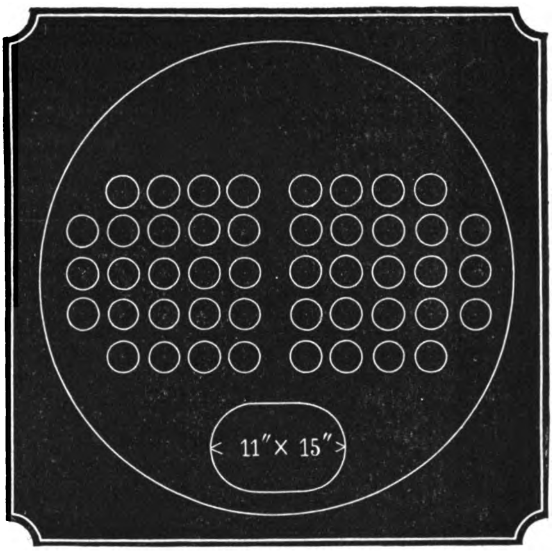


FIG. 1.

The tubular type of boiler is of course common property, in which each builder has his own ideas of what its construction should be, often adding some important kink of his devising. In the main these contributions have been valuable and have made it the successful boiler of to-day, but among the many thousands built annually, occasionally one may be found which, though of first-class construction generally, in some important particulars may be little else than a copy of the weaknesses and defects of twenty years ago. Sometimes this is due more to a want of thought than to a deliberate intention to palm off inferior work. Perhaps reproduced from the recollection of some old construction with which the builder was familiar. But we cannot disguise the fact that a determination to make a profit upon every piece of work, however low the price at which it was secured, and lack of skilled supervision in the interest of the purchaser during construction, accounts for much of the inferior work of other manufacturers.

It will we think be apparent that in cutting away so much of the material composing the front head as may be necessary for the manhole opening, usually eleven by fifteen (11 x 15) inches, we remove 11 x 15 x .7854=129.59 superficial square inches; assuming the head to be half an inch thick, this would be equal to 64.79 sectional square inches. In addition to this, the location of the manhole when fully available involves the loss of the lower tubes and their holding power in staying the heads—we are now simply considering the tube as a stay, not its evaporative efficiency. No doubt the advantage in having clean fire sheets more than compensates for the loss of these lower tubes, which, as has been repeatedly demonstrated, are of little importance and inappreciable in the boiler's performance.

But it is not alone the weakening effect of cutting away so much of the boiler head without providing reinforcement. Corrosion is sure to result from the springing of the weak unstayed section bordering the opening resulting in a leaky joint, followed by vain efforts to tighten the joint and so stop the leak, by excessive screwing up of the plate, causing successively distortion, fracture, and ultimate rupture. Boilers have failed under a hydrostatic test pressure from structural weakness of this kind, and it has been a fruitful cause of steam boiler explosions.

A case in point from our practice was that of two new boilers 60 inches in diameter, heads $\frac{7}{16}$ inch thick, containing 46 4-inch tubes having unstrengthened manholes under tubes in front head very similar to that shown in Fig. 1. This manhole opening was without an internal frame, strengthening ring, or stays of any description. Upon reporting this with a recommendation that this dangerously weak point should be properly reinforced, one report was enclosed to the builder of the boiler, who replied that reinforcement of a manhole of the description was not only unnecessary, but would weaken instead of strengthening the boiler!

The owners of the boiler were unfortunately persuaded to this view and declined to make the additions necessary to properly strengthen the manholes, which we deeply regretted, for they employ many persons who work within range of these dangerously constructed boilers. As for ourselves, we shall be careful when in that vicinity to pass by on the other side and give them the widest possible berth.

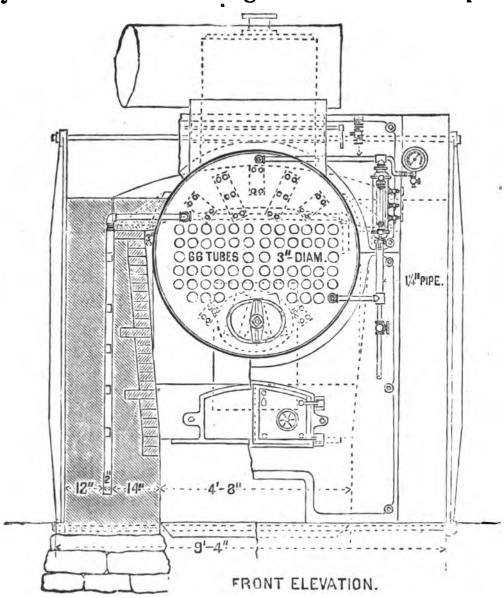


FIG. 2.

Fig. 2 is a front elevation of a 60-inch tubular boiler of the same type, being one of a number designed by the company for a prominent New England manufacturing company. The specification for these boilers provides for bracing underneath tubes on front and back head as follows: "Six (6) on rear head and two (2) on front head below the tubes as shown in drawing, none of which are to be less than three (3) feet long. Braces to be of best round iron of one (1) inch in diameter, and of single lengths."

In the matter of manholes it specifies "boilers, each to have two manholes each eleven (11) inches by fifteen (15) inches, with strong internal frames (as shown in drawing), and suitable plates, yokes, and bolts, the proportions of the whole such as

will make them as strong as any other section of the shell of like area, one to be placed in front head underneath the tubes, and one to be placed on shell of boiler, as shown in drawing."

The Latest Concerning the Glacial Period in America.

In the columns of *The Independent* for March 4, 1880, and March 10, 1881, a somewhat detailed account was given of the investigations of the Rev. G. Frederick Wright, of Andover (now Professor in Oberlin), relating to the chronology of the glacial period. Since that time Mr. Wright has been busy collecting further information bearing upon the subject. In connection with Professor Lewis, of Philadelphia, he has accurately traced for the Pennsylvania Geological Survey the southern boundary of the glaciated region across that state, and during the year past, under the auspices of the Cleveland Historical Society, has followed it across Ohio and Kentucky to the Indiana line.

The southern boundary of the glaciated area of America crosses the Delaware River at Belvidere, a few miles above the mouth of the Lehigh River. Thence its course is through Northampton, Monroe, Luzerne, Sullivan, Lycoming, Tioga, and Potter counties, in Pennsylvania. It just touches the southwest corner of Alleghany County, N. Y., and reaches its northern limit in Cattaraugus County, a few miles north of Salamanca. Thence it turns southwest, running through Warren, Venango, Butler, Lawrence, and Beaver Counties, Pa., entering Ohio, in Columbiana County, a few miles north of the Ohio River. Thence its course leads through Stark and Holmes to Knox County, where it takes a sudden turn to the south through Licking, Perry, Fairfield, Ross, Highland, Adams, Brown, and Clermont Counties, crossing the Ohio River on the line between Campbell and Pendleton Counties, Ky., and re-crossing it near the southern boundary of Dearborn County, Ind.

Down to this line the whole country is covered with unmistakable signs of glacial action. Granite bowlders from the far North are numerous, both on the hill-tops and in the valleys; stones of various kinds are mingled together in the unstratified clay deposits, and are striated as in the ground moraine of Switzerland. South of this line these signs disappear. In the river valleys water has often transported bowlders much farther, but the action of water soon erases the peculiar marks of glaciation and leaves only stratified deposits.

This boundary line is remarkable, both for its indifference to latitude and to elevation above the sea. In Monroe County, Pa., it rises 2,000 feet above the sea without being much deflected from its general course. In like manner it descends 1,500 feet to cross the Susquehanna at Beach Haven, and ascends to 2,000 feet again in Lycoming County, and continues nearly at that elevation until it approaches Ohio. Its sudden turn to the southwest in New York, and to the south in Knox County, Ohio, is not due to any change in elevation. The highest land in Ohio (about 1,900 feet) is in Logan County, north of the point where the ice is extended farthest south. The gradual descent into the valley of the Mississippi may have had something to do with the extreme southern extension, but the sharpness of the flexures in Cattaraugus County, N. Y., and Knox County, Ohio, show that the southern boundary was determined largely by the irregularity of the force pushing from behind. If, for example, snows had fallen in excess over the region of the upper lakes so that the ice was a thousand feet deeper than to the east, the effect would be to push a lobe of ice in the line of the least resistance to the southward of the ordinary boundary.

South of New England, through Cape Cod, the Elizabeth Islands, Long Island, Staten Island, and across New Jersey the southern boundary of the glaciated region is marked by very large accumulations of glacial material, forming hills from fifty to two hundred feet in height along the whole line. West of this the terminal accumu-

lation is not always so marked; but the boundary is everywhere sharply defined, and through a good portion of the distance the excessive marginal accumulation continues. Noteworthy points at which to observe this feature are in Pennsylvania, on Pocono Mt., Monroe County; in the valley of the Susquehanna at Beach Haven; of Conowango Creek, twelve miles north of Warren, and near French Creek, a few miles west of Franklin. Also in New York south of Randolph, and in Ohio near Canton, Stark County; Thornville, Perry County, and Adelphi, Ross County.

The distance to which bowlders found in Ohio and Kentucky have been transported is noteworthy. Ohio is covered throughout the larger part of its territory by the nearly horizontal strata of Carboniferous and Devonian formations. Not only are there no native granitic rocks within its borders, but none are to be found in place to the north short of the shores of Lake Huron. Yet a granite bowlder, 18x12x6 feet in dimensions, occurs near Lancaster, in Fairfield County, Ohio, which must have come from Northern Canada, nearly 400 miles away; and conglomerate bowlders containing pebbles of red jasper, characteristic of the hills about the eastern end of Lake Superior, are found in Boone County, Ky., ten miles south of Cincinnati and 550 feet above the Ohio River.

That the ice-sheet of the glacial period enveloped Cincinnati, crossed the Ohio River, and entered Kentucky a few miles, can no longer be questioned. This fact had been inferred by Dr. Sutton, of Aurora, Ind., and by Professor Shaler. Dr. Sutton, however, had not noticed scratched stones south of the Ohio, and Professor Shaler has not published his observation. But in a recent visit, Mr. Wright has both found deposits of genuine "till," containing granite pebbles and striated stones on the Kentucky hills south of Cincinnati, and has for a considerable distance traced the exact southern boundary of such accumulations in that State. That they are not water accumulations is shown both by the characteristics already described, and by the fact that they are not bounded by any barrier such as would obstruct a body of water. These deposits of transported material cease where the ice ended.

The effects of this extension of the ice-sheet into Kentucky are interesting. The Ohio River occupies throughout nearly all its course a narrow valley about one mile wide and from 300 to 500 feet deep, cut by pre-glacial erosion through the horizontal strata of the coal measures. The passage of the glacial ice across the river at Cincinnati must have formed a dam in its channel 500 or 600 feet in height. This would raise the water in the upper portion of the channel so as to submerge Pittsburg 250 or 300 feet and make both the Alleghany and the Monongahela for a long distance, arms of the interior lake. Very likely this may be the key to unlock the mystery of the extraordinary river terraces both above and below Pittsburg.

All this is preliminary to the question of the date of the close of the glacial epoch. We shall soon know the exact boundary of the glaciated area and shall be able to study at a great number of points the streams which break through this boundary. It will be strange if altogether the extent of the erosion of these various streams does not shed some light on the chronology of the glacial period, and serve as a wholesome check upon the speculative astronomical chronology now so much in favor. So far as calculations have been made they, with great uniformity, indicate a short chronology for the period since the glacial epoch. The post-glacial work done by the streams issuing from the glaciated area is extremely small. The rate at which they work is difficult to determine. Along nearly every stream there are extensive gravel terraces below the glacial limit, like those on the Delaware, at Trenton, N. J., in which Dr. Abbott has found paleolithic implements. Observers should be on the lookout for implements in all these gravel deposits.—*The Independent.*

Delta Metal—A New Alloy.

The great attention which has been given for some years past to the manufacture of alloys, says the *Iron Trade Circular*, has brought many of them into the market, which for durability and economy are unsurpassed when applied to the particular purpose for which they are made. An addition has now been made to the number by Alexander Dick of Cannon street, whose delta metal promises to replace ordinary brass in a large number of cases. Delta metal appears to be, practically speaking, a fine quality yellow metal, hardened and toughened with iron, the result being a fine gold-colored brass of really beautiful appearance. The copper and zinc alloys have always enjoyed a high reputation, but the introduction of iron into them, although successful enough experimentally, has always been wanting in uniformity and reliability when manufactured on the commercial scale. It is this obstacle which Mr. Dick has succeeded in overcoming by first alloying the iron in definite and known proportions with the zinc, and then adding the copper. When ordinary wrought iron is introduced into molten zinc, the latter readily dissolves or absorbs the former, and will take it up in proportions of about 5 per cent., or in some cases in somewhat larger proportions. The exact point of saturation or the proportion dissolved or absorbed is found to vary with the temperature at which the molten zinc is kept during the process; and unless the temperature be ascertained and controlled, the resulting products will be uncertain in their character. To secure the desired uniformity he uses gas or other furnaces that can be made to work at the same or uniform temperatures for heating the crucibles; and he finds that by keeping the crucibles at as high a temperature as possible without the volatilization of the zinc—that is to say, not exceeding about 1200 Fahr.—he is able to produce alloy containing a definite and known proportion of iron, and by adding the zinc and iron thus formed of ascertained and known character to the requisite amount of copper or copper and zinc, he is enabled to introduce any definite quantity of iron up to about 5 per cent. of the zinc contained in the alloy to be produced.

The results of experiments made by David Kirkaldy to ascertain the elastic and ultimate tensible strength of the delta metal were very satifactory. Bar No. 1, of 1¼ in. diameter, was tested as drawn; it was first turned 1.128 in. diameter, or one square inch area, and bore an elastic stress of 49,600 lb., or 22.1 tons per square inch, and an ultimate stress of 75,235 lb., or 33.6 tons per square inch, the ratio of the elastic to the ultimate strength being thus 65.9 per cent. The contraction of area of fracture, which was granular and silky in appearance, was 15 per cent., and the stress per square inch of fractured area was 88,511 lbs. At 50,000 lb., 60,000 lb., and 70,000 lb. per square inch, the extension set in 10 in. were 0.11, 0.82, and 3.73 per cent. respectively, the ultimate being 8.8 per cent. Bar No. 2 was of similar diameter, but annealed, and it was turned to similar area; it bore an elastic stress of 19,800 lb., or 8.8 tons per square inch, and an ultimate stress of 61,130 lb., or 27.2 tons per square inch, the ratio of the elastic to the ultimate strength being 32.3 per cent. The contraction of area at fracture, which was granular and silky in appearance, as in the other case, was 19.9 per cent., and the stress per square inch of fractured area was 76,317 lbs. At 50,000 and 60,000 lb. per square inch the extension set in 10 in. was 10.80 and 16.90 per cent. respectively, the ultimate being 17.5 per cent. Comparing the tensile strength of delta metal with that of iron, brass, and gun metal (taking the figures for the latter metals given in Molesworth's Pocket-book), the results were: Delta metal cast in sand (green), showed a breaking strain of 21.6 tons per square inch; ditto. rolled and annealed, 1¼ in. bars, 27.2 tons; ditto. drawn into wire of No. 22 w. g., 62.5 tons; wrought iron, 22.0 tons; brass, cast, 8.0 tons; brass wire, 22.0 tons; and gun metal, cast, 16.1 tons per square inch; so that there can be no question as the superiority for many purposes of the new alloy.

The comparative cheapness of the new alloy will undoubtedly be one of its greatest

recommendations; and Mr. Dick certainly appears to have full justification for claiming that although delta metal is an improved brass, it is as much superior to it as phosphor bronze is to ordinary gun metal, and as steel is to iron. It can be made as tough as wrought iron, and as strong and hard as mild steel; it can be forged and rolled hot, and will stand being worked and drawn into wire when cold. When melted delta metals runs very freely, and perfectly sound castings of fine close grain can be produced from it; its color resembles that of gold alloyed with silver, it takes a high polish, and when exposed to the atmosphere will tarnish less than brass. The prices of delta metal—ingots, sheets, rods, and wire—are but little in advance of those of the best brass, and vary slightly with the composition of the metal. The uses to which this new alloy can be applied are very numerous; its great strength, durability and hardness recommend it for various kinds of engineering work, whilst its fine rich color has already secured for it a market for cabinet work, harness, and carriage fittings, and in connection with other trades.—*Cotton, Wool, and Iron.*

[The composition of the above described alloy seems to be similar to that of Aitch metal, while its properties resemble those of Sterro metal.—ED. LOCOMOTIVE.]

The Properties of Oils.

M. Chevreul found metals to have, in certain cases, a remarkable influence on the oxidation of oils. Recently, the *Times* says, M. Livache has used, in this relation, finely-divided metal—such as is got by precipitation—instead of metallic plates, and the effect is greatly increased. He thus tried lead, copper, and tin, and found lead to have the strongest action. If precipitated lead, moistened with oil, be exposed in air, an increase in weight is very soon observed, and this is greater the more siccative—or drying—the oil. With linseed oil, the increase of weight reaches a maximum in 36 hours, whereas, exposed alone to air, the oil would take several months to reach this maximum. A solid and elastic product is obtained. With non-drying oils the increase of weight is much less, and takes much longer to be completed. The result in question, M. Livache points out, cannot be attributed to a simple division of the matter, allowing more active circulation of air, for the same experiment made with various other substances in fine division does not result in any like increase of weight; the effect here is merely like that in the case of a thin layer of oil exposed to air. The change in the other case must be attributed to a direct action of the metal. He suggests what industry may derive certain advantages from the facts observed. Thus a rapid method is indicated of distinguishing dry from non-drying oils. Further, the heating of oils might be advantageously replaced by a circulation in contact with air and in the cold state, over iron or fine plates having precipitated metallic lead on their surface. The oils so obtained would be always less colored, and would retain great fluidity, while the objectionable odors and the danger of fire which attend the present mode of treatment would be avoided.—*Cotton, Wool, and Iron.*

The oldest pieces of iron (wrought iron) now known are probably the sickle blade found by Belzoni under the base of a sphinx in Karnac, near Thebes; the blade found by Colonel Vyse, imbedded in the masonry of the great pyramids; the portion of a cross-cut saw exhumed near Nimroud by Layard—all of which are now in the British Museum. A wrought bar of Damascus steel was presented by King Porus to Alexander the Great, and the razor steel of China for many centuries has surpassed all European steel in temper and durability. The Hindoos appear to have made wrought iron directly from the ore, without passing it through the furnace, from time immemorial, and elaborately-wrought masses of iron are still found in India, which date from the early centuries of the Christian era.—*Cotton, Wool, and Iron.*

The Barber's Pole.

To the Editor.—While perusing an article in your last issue, in which you referred to the time when the barber did the work of the modern surgeon, it recalled to me what I once read in a very old work in the British Museum, London, relative to the "barber's pole." It seems that several centuries ago the village barber and the village surgeon were one and the same; and if an accident occurred by which a limb was broken or dislocated, the flesh torn, indeed anything that would call forth the services of a surgeon, the barber was the first summoned. But barber shops at that period were not nearly as numerous as they are now, and, in consequence, a difficulty often arose in finding them, especially as they had no sign to denote their whereabouts. The City Council of London at length made an order that barbers should extend from their shop front a sign, the shape of which should be that of a man's arm, and that it should be painted red to represent blood, while white bandages were to be placed around the arm. Soon it became a universal order, and in this way the barber's pole first originated. Though, of course, as years have rolled past and customs changed, the pole has assumed more varied and ornamental shapes.—*W. M. Hill, in "Steam."*

"Pure Liquors."

HOW SOME FAVORITE TIPPLES MAY BE CONCOCTED.

One of the gentlemen who has been engaged in the temperance work with Mr. Graham, under the auspices of the Episcopal church, has been investigating the matter of the adulteration of liquors. In the course of his inquiries he obtained a copy of a small pamphlet, giving directions, recipes, and processes for the production of various kinds and qualities of brandies, gins, whiskies, rums, bitters, cordials, and all other liquors, by the application and use of essential oils and essences, manufactured by —— of —— and ——, branch of —— & Co. of ——, Germany. This is printed, of course, for "the trade" and circulated privately. The preface of this curious little book reads:

"The manufacture and compounding of liquors, cordials, and other spirituous beverages by the use of essential oils or essences—without the more intricate and expensive process of distillation—has of late years assumed such vast proportions, as to necessitate their appliance by the majority of distillers and dealers in this country."

The evident object of the work is to induce liquor dealers to manufacture for themselves, and it is not at all unlikely that some may do so. That liquors as generally sold in the market are largely adulterated is not denied. As illustrations of the concoctions a buyer gets and his customer drinks, the following recipes are interesting:

"*Cognac Brandy*—(for 40 gallons)—Cognac oil, best genuine, 2 drachms; Jamaica rum essence, 4 ounces; glycerine, chemically pure, 1 pound; cologne spirit, proof, 40 gallons.

"*Jamaica Rum*—A very fine article, (for 40 gallons)—Jamaica rum essence, 12 ounces; old genuine Jamaica rum, 2 gallons; glycerine, chemically pure, 2 pounds; cologne spirit, proof, 38 gallons; color with sugar coloring.

"*Scotch Whisky*—(for 40 gallons)—Scotch whisky essence, 3 ounces; glycerine, chemically pure, 1 pound; cologne spirit, proof, 40 gallons."

The preparation of wines is consigned summarily to a few general remarks, towards the close of the pamphlet, which are quoted as follows:

"An almost annual return of diseases affecting the grape has not only reduced the quantity of the vintage, but also deteriorated the quality of the wines; from this the necessity has arisen to replace, by artificial means, that which nature has failed to produce. This has caused us to put upon the market the following Wine Bouquet essences: Catawba, Madeira, Port wine, Sherry wine, Medoc, Rhine wine, Moselle wine,

Riesling, and Muscateller, which, by using ingredients, selected with a special care to health, have made them well known and extensively used in all principal wine marts of Europe, and already secured for them an extraordinary favorable reception by the trade here. Red wines are often deficient in tannic acid; this want has been especially provided for in our Medoc Bouquet essence."—*Hartford Courant.*

The Population of the Earth.

As an authority concerning the population of the different countries of the world, the publication called "Die Bevolkerung der Erde," published by Justus Perthes, of Gotha, occupies a high position. From the seventh issue of this work, which has recently appeared, we find the total population of the globe estimated at 1,433,887,500, an apparent decrease in the estimate of 1880 of about 22,000,000, while the recent censuses of all the great countries show an increase of over 30,000,000. This is, however, partly explained by a readjustment of the population of China, which, formerly given at 434,-626,500, has now been carefully revised and estimated at 371,200,000. After this change of figures for China, Asia is set down as possessing a population of 795,591,000; this includes the 252,000,000 for British India, and the 14,500,000 of the territory of Russia in Asia. The results of recent censuses in Europe show an increase in the population, which is now stated at 327,743,400, as compared with 315,929,000 in 1880—an increase of about 12,000,000. Africa is set down as having a population of 205,823,260; America, 100,415,400, and Australia and Polynesia, 4,232,000. Before some of these vast numbers the total population of the United Kingdom at last census (35,000,000) does not bulk largely, but this is more than counter-balanced by the vast power and influence wielded by our country in every portion of the habitable globe.—*Chamber's Journal.*

MANUFACTURING STATISTICS.—Census Bulletin No. 302 embraces a table of statistics of manufactures in the United States, showing the capital invested, the number of hands employed, the amount of wages paid, the value of materials used, and the value of products for all the establishments of manufacturing industry, gas excepted, in each of the States and Territories, as returned at the census of 1880. The following are the totals: Number of establishments, 253,840; capital, $2,790,223,506; average number of hands employed, males above 16 years, 2,025,279; females above 15 years, 531,753; children and youths, 181,918; total amount paid in wages during the year, $947,919,674; value of materials, $3,394,340,029; value of products, $5,369,667,706.

New York is credited with 42,739 establishments; a capital of $514,246,575; value of materials, $679,578,650, and value of products, $1,080,638,696.

Pennsylvania is next, with 31,225 establishments; capital, $474,499,993; value of materials, $462,977,250; value of products, $744,748,045.

Massachusetts, with 14,352 establishments, employs a capital of $303,806,185, uses $386,952,650 worth of materials, and turns out products valued at $631,511,484.

Illinois, with 14,549 establishments, employs a capital of $140,652,066, uses material valued at $289,826,907, and turns out products valued at $414,864,673.

Ohio, with 20,699 establishments, employs a capital of $188,939,614, consumes material valued at $215,098,026, and turns out products valued at $348,305,390.

Next in order in value of products, but not in number of establishments, capital employed, or value of material, follow Connecticut, Missouri, Michigan, Indiana, Wisconsin, California, Maryland, and Rhode Island, showing products ranging from $185,680,211 for Connecticut, to $104,163,623 for Rhode Island.

The other States and Territories are all below $100,000,000 in value of products.

—*The Iron Age.*

MACHINERY for underground use of a higher class than has been employed before is now in course of adoption in South Staffordshire. There has been introduced at the Cannock and Rugeley collieries, Hednesford, an air-locomotive that gives very satisfactory results. The *Colliery Guardian* reports that the engine is one of Lishman & Young's, and has been made by the Grange Iron Company, near Durham. It has a pair of 4½ inch cylinders with 8 inch stroke, and is fitted with all the working parts of an ordinary steam locomotive. The receiver (the substitute for the boiler) is 6 feet 6 inches long by 3 feet 6 inches diameter, and is made of Siemens's steel plates. The engine is now working at a pressure of 300 pounds to the square inch, but will stand a pressure of 500 pounds. It is situated at a distance of 1,200 yards from the bottom of the shaft. It goes into the stalls and brings the coal directly from the face of work, a distance of 250 yards, delivering it to a station at the bottom of a trough vault. At this, a hauling rope takes hold of the trains and draws them up to where the main hauling engine takes them to the shaft. This main engine is stationed on the surface. It has a 32 inch cylinder, and besides hauling it compresses the air necessary for the smaller air-locomotive. The air cylinder of the main engine is 20 inches in diameter, with 5 foot stroke, and the air is compressed to 65 pounds per square inch. The air at this density is conveyed down the shaft in large receivers, and is taken along the mine a distance of 850 yards. Here a pair of 12 inch engines work a 5 inch compressor, and further compress the air up to 300 pounds per square inch. It is then led into a small receiver, and is taken to a point at which the air-locomotive can be charged,—an operation that occupies only half a minute.—*Engineering and Mining Journal.*

IMPROVEMENTS IN WELDING.—The *Mining and Scientific Press* says it seems almost probable that, just at the time when the chief difficulties in the way of welding disappear by reason of our better knowledge and skill in manipulation, the necessity for welding in large masses will be avoided by the use of cast metal. "Heavy hammers, furnaces with neutral or reducing flames, and increased facilities for handling masses of metals, have been making more and more difficult forgings possible, but the introduction of cast steel of almost any desired quality seems to be likely to render forging an art of the past. In smaller masses, like boiler plates, great progress is being made both in this country and abroad. Bottles, buoys, small boiler shells, fire-boxes, and, in fact, an immense variety of shapes, are now being made out of plate iron without seams or rivets. Very considerable advance is being made in the production of seamless tubes of large size, flat-welded, and cylinders with the head welded together seems to be an unanswered question, the only difficulty being the want of proper plant to manipulate the sheets. Hydraulic welding is making great advances, and some of our large locomotive works are doing very remarkable work in this way. It is notable, however, that in this large work, although an enormous pressure is necessary, the pressure must not be too great, for otherwise the metal which is sufficiently soft to form the weld will be squeezed out and the cooler metal only remain."—*Mechanics.*

COLORS MADE BY THE HUMAN VOICE.—The *Philadelphia Press* of June 2d says: An optical demonstration of the effect of sound on the colors and figures in soap bubbles was given at the Franklin Institute recently by Prof. Holeman. A film of soap was placed across the end of a phoneidoscope. To bring the sound in direct contact with the soap a tube was used. A reflection of the film was thrown on a canvass screen, where it first assumed a bluish-gray appearance. An intonation of the voice, with the lips close to the mouth of the tube, caused a number of black spots to appear on the reflection. When these passed away a beautiful light green, intermingled with pink, remained. These two appeared to be the principal colors caused by sound. It was noticeable, however, that while a certain tone would cause the same figure to reappear, it had no control over the color. A tone which, for instance, caused one solid color to appear, would bring out, perhaps, a dark blue at one time and a yellow at another. No difference was noticeable in the effect of the male and female voices.

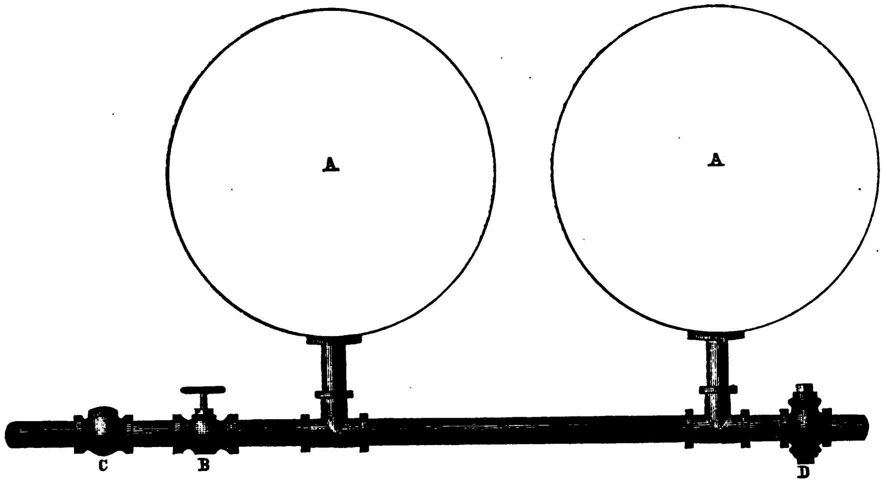
The Locomotive.

PUBLISHED BY THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY.

NEW SERIES—VOL. IV. HARTFORD, CONN., AUGUST, 1883. No. 8.

About Feed and Blow-off Attachments.

Figure 1 shows a very common form of making the feed-water connection for a battery of boilers which prevails to an uncomfortable extent in many parts of the country. It may be described as follows:



A. A.—Cross sections of two cylinder boilers,
B.—Globe valve.
C.—Check valve.
D.—Blow-off cock.

It is a very ordinary occurrence in these localities for the interior boiler of a battery to become short of water; be overheated, bulged or collapsed, and oftentimes ruptured, doing more or less damage, according to circumstances and surroundings.

With such an arrangement of pipe-connections, this is always possible, and may result from some one of the following causes: a more direct draft to the chimney or smoke-pipe; heavier firing, or cleaner boiler-sheets and tubes; allowing the fires in one furnace to become dirty and dull, while that of the adjacent furnace is clean and bright, etc.

In feeding boilers the feed-water will pass into the boiler through the connection offering the least resistance; therefore, under ordinary circumstances, the larger amount will go into the boiler nearest the supply, and I have always found it necessary in feeding several boilers upon the same line of feed-pipe to equalize the flow by partially closing the globe-valve upon the nearest boiler, and so graduating the lift of valves upon the other boilers as to make the feed uniform. But this cannot be done where boilers are connected as illustrated in Fig. 1, which is based apparently on the assumption that where the feed is on, each boiler is getting an equal amount of water. Practically this

is rarely the case, and when some difficulty occurs by which one boiler loses its water, the true condition of affairs is not detected until too late.

At night, under banked fires, a dangerously common practice in some establishments during cold weather, there is great danger of the water being backed out of one boiler into that of the adjacent ones. A peculiar case of the kind occurred in Brooklyn some few years ago to some flue boilers under banked fires. A sudden change in the weather, from a dull, muggy atmosphere, to one bright, clear, and cold, accompanied by a brisk wind, which is supposed to have quickened the fire and set it aglow under one of the boilers—perhaps it had only been lightly covered up when banked—with all the steam-outlets closed from the upper part of boiler, it began to accumulate pressure and "kicked" its water into the adjoining boiler, which left its flues uncovered, causing overheating and collapse, with a considerable destruction of surrounding property.

This feed-connection has not only large possibilities in the way of danger from over-heating, over-pressure, or collapse, but is also injurious because the difference in temperature between the entering feed-water and that of the bottom plate upon which it is emptied, is still very considerable under the most favorable circumstances, and is the cause of many fractured plates and leaky seams. And it is wasteful, for the production of steam is irregular, and the draft difficult to regulate.

Each boiler should have its feed and blow-off connection through separate pipes. The feed is best introduced at the front near the water line, for the valves are there within easy reach of the engineer, and continually under his observation. It should have suitable connections inside the boiler to ensure its delivery at the coolest place in the boiler where it will do the least damage, while the blow-off will be found most serviceable when attached to the boiler bottom near the back end. The location of feed, Fig. 1, at back end of boiler, is admirably adapted for a blow-off pipe, and steam-users who have their boilers connected in that manner will consult their best interests by making the change, putting in a blow-off cock or valve so that they may be blown off independently, and fitting up a separate feed connection, with suitably attached globe and check valve for each boiler.

To those who are wedded to the use of such a feed-connection as we have described, *i. e.* without check-valves, let us suggest making the pipe connections between the boilers of not less than eight inches internal diameter. This will equalize the pressure better than a smaller connection; and to that extent lessen their danger. We would stipulate then they should not be used except once a common furnace, by which we mean one undivided furnace for the whole battery.

The use of mud drums is very general in parts of the country where mud and sediment contaminate the feed-water, the purpose of the mud-drum being to afford a separate vessel farthest removed from that part of the boiler in which the most violent ebullition occurs, into which mud and sediment will subside where it does the least damage, and from which it can easily be removed or blown out. But in nine-tenths of the cases of boilers so arranged that have come under the writer's attention, the feed-pipe is connected to the mud-drum, and feeds through it to the boiler, which, of course, must keep its contents in a state of agitation, thoroughly mixing up the mud and settlings, assuming that mud or sediment does subside within it during the time when there is no feed on. If so, when agitated by the feed it must be forced into the boiler again, thus defeating the very object of its use.

Inspectors' Reports.

JUNE, 1883.

Below is given the summary of the work of the Inspectors for the month of June last, with the exception of one of the large departments, the reports from which were not all in at the time of going to press. The reports, so far as received, show that 2,220 inspection trips were made, 4,172 boilers were examined, 1,676 of which were inspected internally, 341 were tested by hydrostatic pressure, and 51 were condemned. The total number of defects reported foots up 2,600, of which 399, or over fifteen per cent., were considered dangerous; as per the following detailed statement:

Nature of defects.	Whole number.	Dangerous.
Cases of deposit of sediment,	271	24
Cases of incrustation and scale,	505	33
Cases of internal grooving,	26	10
Cases of internal corrosion,	69	16
Cases of external corrosion,	146	31
Broken and loose braces and stays,	34	14
Defective settings,	125	6
Furnaces out of shape,	69	4
Fractured plates,	87	48
Burned plates,	76	15
Blistered plates,	196	13
Cases of defective riveting,	127	43
Defective heads,	21	6
Leaky tubes,	316	50
Leaky seams,	187	19
Water gauges defective,	77	12
Blow-out defective,	29	4
Cases of deficiency of water,	15	6
Safety-valves overloaded,	32	7
Safety-valves defective in construction,	20	11
Pressure gauges defective,	171	26
Boilers without pressure gauges,	1	1
Total,	2,600	399

Leaky seams are sometimes one of the most troublesome defects to which steam boilers are subject. The causes of this defect are various. Sometimes it arises from defective construction of the boiler, the joint is not staunchly made originally, or the drift pin may have been used too severely, thus buckling the plates to such an extent that no amount of caulking will keep the seams tight under ordinary circumstances. If the plates do not come together truly when the lap is made, that is, if they are crooked, and buckled between the rivet holes, they cannot be drawn together by the process of riveting, and too much caulking is required to keep the joint tight. When this is the case, it is found that no amount of caulking will prevent leaking for any great length of time. The seams are always leaking and corroding, and in a short time patches have to be put on. If boiler makers would pay more attention to the matter of making good, smooth laps, with the rivet holes fair and true, they could dispense with about one-third of their rivets and have a stronger and better joint. It is now established beyond the shadow of a doubt, that a joint can be made perfectly tight for pressures up to 150 pounds per square inch, by pitching the rivets from 3 to 3¼ inches in a ⅜-inch plate. We

say it is established beyond the shadow of a doubt, because it is now regularly done by some of the best boiler makers, and they tell us that the seams hold better than they did when they put the rivets in as closely as they could conveniently drive them. They say that the staunchness of the joint depends more upon the nicety with which the plates fit together, than it does upon the pitch of the rivets.

BOILER EXPLOSIONS.

JUNE, 1883.

SAW-MILL (76).—The boiler of Blackburn & Snider's mill at St. Landry Parish, La., exploded this morning, June 1st, killing two men and wounding eight men and two boys. The mill was blown to atoms.

SHINGLE-MILL (77).—At 8.30 A. M. the boiler in the shingle-mill of G. V. Turner & Son, eight miles below East Saginaw, Mich., exploded with terrific force, shattering the mill building into fragments, which were scattered in every direction, and only a pile of brick, mortar, and remnants of the walls mark the spot where the boiler-house stood. Portions of the boiler were thrown in all directions. The steam-dome going into the air and descending passed through the roof of the salt shed and crushed into three tiers of salt barrels. The fire-front was blown several rods to the west and passed through a small house, fortunately empty. Another piece, in its flight through the air, carried off a portion of the smoke-stack on a drill-house that stood some distance away to the north, and another piece smashed in a corner of the drill-house. Still another piece fell into the bayou a long distance to the west. Three men were torn into pieces instantly. Their names were: William G. Turner, a son of the proprietor of the mill, who was also the engineer; Hiram Goulding, fireman, and John McDowell, night watchman. There were thirty men about the premises at the time of the explosion. The capacity of the mill was 70,000 shingles per day. The loss is $5,000.

PILE-DRIVER (78).—By the explosion of the boiler of a pile-driver engine on the Memphis & Charleston railroad yesterday, near Lagrange, Tenn., engineer Harry Roberts and fireman Lee Transcomb were killed outright, and Tom Farr Smith, an engineer, and a man named Tom Atkins, were seriously injured. Roberts was formerly an engineer on the river. He leaves a wife and three children living at Iuka, Miss.

SAW-MILL (79).—The boiler in the mill of Farnham & Lovejoy, Minneapolis, Minn., exploded June 6th. Matt Tierce, the fireman, had an arm and shoulder broken.

RUBBER-WORKS (80).—At College Point, L. I., last night, June 9th, a cast-iron vulcanizer weighing nearly five tons, in the factory of the Ansonia Rubber Works, burst. A piece of iron weighing several tons was blown through the roof of the factory, and fell into a vacant lot, nearly a block away. The roof and the larger part of the side of the main building of the factory were demolished. The damage will exceed $12,000. Jacob Jackson, an engineer, was shockingly scalded; Andrew Hoppe had both arms broken, his eyes put out, and the flesh upon his body was literally cooked; William Kelly was struck by a piece of the iron, and had his skull crushed. Two other workmen were fatally hurt.

STEAM-TUG (81).—The boiler of the tug Athlete exploded this morning near Fernandina, Fla. Captain Devette was blown through the wheel-house and killed. Two other men were fatally injured. The tug was wrecked.

RUBBER-WORKS (82).—Thomas Culleton, aged sixty years, and Michael Hawk, aged thirty-five years, were instantly killed by the explosion of a rubber vulcanizer, or heater, of which they had charge, at the Trenton, N. J., Rubber Works, this morning. The men neglected to blow off the steam before they commenced to unscrew the bolts of the door. When a few bolts had been freed the strain came too heavily on the others, and the explosion followed. The door blew out, and the men were whirled with terrific force through a brick wall twenty feet away. The vulcanizer itself was thrown backward fifty feet, through two brick walls, into the car-spring shop, where a dozen men were employed. The escape of these men without injury seems almost miraculous.

SAW-MILL (83).—The boiler attached to a saw-mill belonging to Cottrill & Kennedy, and located near Fortville, Ind., exploded this evening with terrible effect. Mr. Cottrill was so severely scalded that he will die, and his partner, Kennedy, was instantly killed. The mill is almost completely wrecked.

SAW-MILL (84).—A dispatch stating that the boiler in the saw-mill of M. A. York, at Bernamwood, Wis., a place about seventy miles from Appleton, had exploded June 15th, completely wrecking the mill and killing the watchman. It was very early in the morning, before the men had come to work, otherwise the destruction of life would have been very great. The total loss is not known, but probably about $50,000.

MACHINE-SHOP (85).—Just before noon, June 20th, the boiler in the engine room of H. E. Penney's machine-shop, on the alley back of No. 315 Third avenue south, Minneapolis, Minn., exploded with disastrous effects, the entire engine room being practically demolished. A young man named Willie Lunburn, who was employed at the shop, was knocked down and covered with the debris, and severely scalded by the escaping steam. Mr. Penney attributes the explosion to the rottenness of the iron in the boiler, and estimates his loss at between $1,000 and $1,200.

SAW-MILL (86).—The boiler in the mill of Behymer, Holbrook & Styles, seven miles from Shawneetown, Ill., on the Ohio and Mississippi road, exploded June 20th. Besides injuring the mill, a lot of lumber was destroyed, and a switch and a section of track were torn up. Loss, $15,000; no insurance. Eight men working about the mill escaped uninjured.

PAPER-MILL (87).—About 9.30 o'clock on Wednesday evening, June —, an explosion occurred in the Ghent Paper Company's mill, located about one mile northeast of Ghent village, N. Y. The only employees in the mill at the time were William Watson, the engineer, and a lad named Lampman. The crash was heard by W. H. Sliter, the manager, at his house, about 300 feet distant, and he ran down to the mill. He discovered that three of the four cylindrical dryers had exploded. Fragments of the machinery were scattered in all directions and Watson lay on the floor in an unconscious condition. His skull had been fractured by a piece of the iron and the blood flowed in a stream from the wound. The damage to the machinery, etc., by the explosion, is estimated at between $3,000 and $4,000. The disaster was doubtless caused by an over pressure of steam on the cylindrical dryers, which were apparently defective in construction.

THRESHING MACHINE (88).—Yesterday afternoon, June 21st, a steam engine attached to a threshing machine, at work eight miles from Greenville, S. C., exploded. The connecting band had broken, the engine had stopped, and a number of laborers had gathered to assist in repairing it, when the explosion occurred without warning, scattering the bystanders in every direction and throwing some of them thirty yards away.

WOOLEN-MILL (89).—The boiler at Gants' woolen-mills, near Boonville, Mo., exploded June 22d, wrecking the building and machinery. Several men were injured, but only one, the engineer, dangerously. The mills were valued at $50,000.

WELL (90).—A boiler exploded at a well on the Clapp farm, Kendall Creek, near Bradford, Pa., June 22d, killing the engineer and demolishing the rig.

MILL (91).—A boiler in the mill of Ives & Hale, at Whittlesey, six miles north of Medford, Wis., exploded June 28th, totally demolishing it, and killing the following persons: Donald Gerrish, engineer; John Spencer, fireman, colored; John Stoner. One was taken in the throes of death from beneath the boiler ruins, the second had his head blown off, and the third had his head crushed by falling timbers. Charles Stenhouser, Dan Moran, and C. Tuttle were badly scalded.

STAVE FACTORY (92).—At a stave-factory in Marshfield, Wis., recently, the man-hole plate blew out of a boiler, filling the fireman's pit with boiling water to the depth of eighteen inches. The engineer and assistant narrowly escaped being scalded to death.

FOREIGN.

STEAMER.—The steamer Iskatermburg, plying on the river Volga, Russia, exploded her boilers May 17th. Twenty-seven persons were wounded by the explosion.

TUG-BOAT.—An explosion occurred June 13th, on board a tug in the Rio Chuelo, South America, killing eight persons and seriously injuring nine others. Four were blown a great distance and horribly mutilated, and one was smashed to pieces against a house.

SAW-MILL.—The boiler in Grainger's steam saw-mill, on the fourth concession of the township of Gosfield, Essex County, Ont. [the county opposite Detroit], exploded June 2d. Richard Stewart, the fireman, was blown about four rods, and striking against a pile of lumber was instantly killed; Robert Hagan and Henry Grainger were badly scalded, and Grainger also had some of his teeth knocked out by being struck by fragments of the boiler. There were but sixty pounds of steam on at the time of the explosion.

An Old World Project.

Of the proposition elsewhere mentioned, to build a maritime canal through Palestine, the *London Railway News* says an English company, with the Duke of Marlborough at its head, has been formed for the purpose of making investigations and preliminary surveys. So far as at present proposed, the work will include, in the first instance, a canal twenty-five miles in length, from Haifa, in the Bay of Acre, through the plain of Asdraelon to the valley of the river Jordan. The depth of the proposed canal is to be forty feet, and its width two hundred feet. This will bring the Mediterranean into the heart of Palestine, and go far towards making a seaport of Jerusalem. It is further proposed to construct a canal twenty miles in length from the head of the Gulf of Akaboah to the Dead Sea, and thus unite the waters of the latter with the Red Sea. If these things were successfully performed it is expected that an inland sea about three hundred miles long, varying in width from three to ten miles, and deep enough to float vessels of the largest size, would extend from the Mediterranean to the Red Sea. There are some matters besides engineering difficulties which may hinder the execution of this project. The consent of the Porte is indispensable, and certain European powers would undoubtedly oppose the granting of a firman conferring upon England the exclusive right of way by water through Palestine. The Holy Land has also sacred associations for Christians throughout the world, and a wide-spread sentiment among all churches and sects would doubtless be raised in opposition to the innovation. Speaking of this particular subject the *London Times* says: "It is possible that the new enterprise may be proved to the satisfaction of many devout men and women to be the fulfillment of the prophecy of Ezekiel, to the effect that there is to be a broad sea in the desert, and that 'the fishers shall stand upon it from En-dedl even unto En-eglaim.'"

The Locomotive.

HARTFORD, AUGUST, 1883.

Dangerous Boiler Settings.

In setting a horizontal tubular boiler the brick-work of the furnace is so adjusted as to expose nearly or quite one-half of the exterior surface of the boiler to the direct action of the heat, but care is taken to close in the brick sides of the setting at a point below which the water never falls except through carelessness and neglect. It will be readily seen that if the fire and direct heat from the furnace is allowed to come in contact with portions of the boiler that are not protected by the water within, there will be danger of burning the iron and destroying its strength.

We call attention to this danger from the fact that we have found boilers so set that the fire line is above the water line of the boiler, and a strip of varying width, extending the whole length of the boiler is exposed to the action of the fire without the protection of water within. The evident object of this plan of setting is to get as much heating surface as possible, so as to secure great evaporative efficiency. But in the effort to secure this efficiency safety is forgotten. It should be borne in mind that "efficiency" at the expense of safety is not economy, and while a boiler may apparently do unusually good service at first by some such plan, it may prove very expensive in the end in repairs, and in greatly shortening the working age of the boiler. Any device that ignores sound principles is dangerous, and the effort to gain an advantage by such practices, where the party doing them is intelligent enough to know the danger, is inexcusable. It is introducing an element of trickery that should not for a moment be tolerated. A person setting a boiler may be ignorant of the danger of bringing the fires of the furnace in direct contact with unprotected iron, but with a full knowledge of the danger, there is no excuse.

ANY circulars of patent boilers, or patent boiler attachments, or boiler "purgers," having endorsements signed or purporting to be signed by agents or inspectors of the Hartford Steam Boiler Inspection and Insurance Company are unauthorized, and will not be recognized. No one is authorized to sign such endorsements save the officers of the company.

PNEUMATIC TRAMWAY COMPANY.—Mr. James L. White, of New York, has favored us with photographs of the "Compressed Air Locomotive," which is said to be in successful operation on an ordinary surface road in Paterson, New Jersey. It is thought that with one charge of air it will draw a loaded car a distance of ten miles. On the road in Paterson there is quite a long incline of between 400 and 500 feet to the mile. This seems to be a practical demonstration of what has so long been needed, viz., some method by which street cars can be propelled by compressed air.

MILLS' NEW ENGLAND STATES STEAM USERS' DIRECTORY has just been issued in neat and attractive form. It contains a full list of the users of steam boilers in New England, with the number of boilers in each mill, together with many valuable hints for steam users. It can be obtained of the J. N. Mills Publishing Company, 145 Broadway, New York.

HENRY CLAY once owned the lot opposite the White House in Washington, and Commodore John Rodgers wanted it, but the old Whig persistently refused to dispose of it. On his return from the Mediterranean the Commodore brought in one of his vessels a fine Andalusian jackass, which Clay wanted for his Kentucky stock farm. All his offers were rejected, until one day the Commodore said: "You can have him for your lot opposite the White House." "Done," was Clay's reply, and the animal was shipped off to Kentucky. The Commodore built the now historic house which Secretary Seward occupied during the war. Here Payne endeavored to assassinate him on the night when President Lincoln was shot. The lot is now valued at $40,000.—*Pittsburgh Despatch.*

Cast Iron Boiler Fronts.

Cast iron boiler fronts, as used upon externally fired flush front boilers, are generally unattractive in appearance, ill-fitting, and destitute of all ornamentation. We can understand why this should have been so twenty years ago, when the darkest and dirtiest hole about an establishment that could not be used for any other purpose was generally selected as the fittest place to put the boiler; but of late years, there has been a change for the better, boilers being placed in well-lighted vaults in our cities, or in boiler-houses provided with a sufficient number of windows to afford ample light in other places where ground space is not so valuable, a change our boiler-makers have failed to properly recognized by designing an attractive boiler front, which would be a credit to themselves, and in keeping with the boiler's improved surroundings.

Cast iron work can be so easily and cheaply ornamented, there is no excuse for the ordinary flat-faced boiler fronts which disfigure nine-tenths of our boiler-rooms. Steam-users would be benefited could a huge bonfire be made of the old style patterns for boiler fronts, so we might start afresh with fronts of tasteful design, and adapted to the purposes of their use. The old front has long blocked the way of several modern reforms in boiler setting, chief among which is that of allowing a distance of from twenty to thirty inches between boiler bottom and grate, while that of the old construction rarely exceeded fourteen inches, for which castings might be had at many of our boiler-shops and iron-foundries,—while for the modern design with a few notable exceptions there was neither patterns nor castings.

Boiler-fronts are often kept very dirty and untidy in appearance, much more so than need be. In cleaning fires and dampening ashes, it is unavoidable that some dust shall be blown about and against the boiler fronts, but the quantity may be considerably lessened by exercising ordinary care.

I have found it a good plan to have a pile of wet ashes from a previous cleaning, which, when covered lightly over those just drawn, keeps down much of the usual cloud of dust which arises and envelops everything in the engine and boiler room, where hot clinkers and ashes are dampened with a hose. A pile of wet ashes is also a very handy thing to cover up a fire with in any sudden emergency, and is much safer, effective, and more comfortable to use, than an attempt to haul fires at such times.

Lamp black and oil are commonly used to paint boiler-fronts, which are kept presentable afterwards by frequent rubbing down with a piece of oily waste or rag. Asphaltum varnish is recommended for the same purpose, and has the advantage in appearance of giving a glossy coat or finish instead of the usual dead, lustreless hue. F. B. A.

Economy in Lubrication of Machinery.

By Geo. N. Comly, Edgemoor, Wilmington, Delaware.

[The following paper and discussion thereon at the Cleveland Meeting of the American Society of Mechanical Engineers, upon a subject of general interest to steam users, we reprint from the "American Machinist."]

In large manufacturing establishments the sum of money paid annually for lubricants is surprisingly great, and where oil is the lubricant the quantity wasted is a very large percentage of the total amount purchased.

Being convinced that such was the case, I endeavored to ascertain the actual quantity of lubricating material used in a given time on the various machines and in the various shops connected with the establishment at which I am engaged.

The result was startling, and the investigation proved that one of the most extravagant users of oil was the vertical engine used for driving the principal part of the works used for machine shop and bridge construction, etc.

The engine was nominally 60 horse power, with 16-inch cylinder and 18-inch stroke, with an 84-inch diameter pulley, making 106 revolutions per minute, but the indicator cards were evidence of the fact that frequently 83 horse-power were produced by the engine.

Owing to the fact that the engine was overloaded, the crank-shaft bearings and crank pin gave much trouble by heating, and occasionally it was necessary to stop the engine during working hours.

The expense for lubricating oils on this engine during the month of May, 1882, was at the rate of $\frac{53}{100}$ cents per hour of the time during which the engine was actually running. The oil used was cosmo-lubric No. 2, costing 65 cents per gallon, and the specific gravity of the oil was 26° Beaume.

During June the oil cost $3\frac{91}{100}$ cents per hour run, and the engine was running 120 hours per week, or an average of 20 hours per day.

About the 1st of July, I commenced using No. 10 lubricine-grease on the crank-shaft bearings *instead* of *oil*, and the result was the engine shaft bearings worked much cooler, gave no more trouble, and the cost of the lubricating material was reduced to $1\frac{15}{100}$ cents per hour run.

The crank-pin at this time was still using oil, and continued so doing until October 9th, when I had a copper box attached to the stub-end of the connecting rod close to the crank pin with a ½ inch tube connecting the box with the crank-pin bearing, and No. 4 lubricine-grease packed in it. No. 10 lubricine was also applied to the guides for the crosshead, the result being that the cost of lubrication was still further reduced to $\frac{78}{100}$ of 1 cent per hour run, and the guides and pin worked much cooler than they did previously when oil was used.

A mixture of palm-grease and beeswax in proper proportions will compare favorably in efficiency to the lubricine-grease.

I have also found mixtures of beeswax and tallow or beeswax and suet to work very well as lubricants for shafting. The relative proportions must, of course, be made to suit circumstances.

During the past eight months the line shafting has been running *without oil*, depending exclusively on the mixtures such as already described. The shafting is all provided with ball and socket hanger boxes, and the top half of the box has two cups cast in it, in which grease is packed, each having a cast-iron cover fitting closely over it to keep out the dust. This cover is chained fast by a very light chain, to prevent it from being lost or knocked down by ladders, etc.

The center oil hole, where a self-oiler is usually placed, should be stopped up with

a cork to keep out dust at that point, and the use of oil is not allowed on any of the shaft-bearings where the grease can be applied.

By the regulations already described, the cost of lubricants has been reduced $44\frac{6}{10}$% in the cases noted above.

Means have been provided for using the grease on nearly all of the engines running at the works, and on several of the heavy machines, the result being a saving of lubricant and cool running of the journals.

It is better, when applying the grease, to make large holes in the caps of the bearings (perhaps 1¼ or 1½ inches diameter, if allowable), and permit the grease to be packed directly on the journal surface. Where this cannot be done, a funnel-shaped cup is attached to the oil hole, in which is a copper-rod, one end of which presses against the shaft, while the other end passes through a spiral spring, which is tightened to the required tension by a screwed cap. The cup is filled with the grease, and the rod passsing though it melts the grease by the heat caused by the friction of the copper rod on the journal, the spring being tightened sufficiently to produce the necessary friction on the end of the rod.

Plain copper boxes, however, are frequently preferable, with lids to keep out dust. A piece of copper rod run through the center of the box touches the shaft, and the hole between box and shaft is made much larger than the size of the rod or copper, so that the grease can be well pushed down on to the shaft.

After reading the above paper, J. J. Grant said they (Grant & Bogert Machine Tool Works) were running their line shaft with similar lubrication. The bearings were always cold, and the cups required no attention. He considered it a great success.

Mr. Comly said, in explanation, that the boxes were originally of bronze; then they lined them with a composition of lead and antimony. But, although they run better, they always run hot till they used lubricine, when they had no further trouble.

C. J. H. Woodbury said his observations were that grease cost less, but that the friction was greater than with oil. He instanced a mill where the change had been made from oil to grease. It was thought that the friction was increased, so two shafts equally loaded, were tried—one with grease and the other with oil. He tested the matter, and found that where oil was used the temperature was increased but eight degrees; where grease was used the increase was thirty-eight degrees above the temperature in the room. The friction surface was 135 per minute; pressure, fourteen pounds per square inch. The friction was increased 33 per cent. by the use of grease. He thought the oil used by Mr. Comly was too light for heavy bearings. Cotton mills generally were using lighter oil. In one mill, where the power was limited, the output was increased five per cent. by the use of lighter oil. In another instance they could run with the gate partially closed. Where journals would not run cool, however, it was necessary to use heavier oil, or even grease, and submit to loss from increased friction.

ASPHALT AS FUEL.—The *Mexican Financier* says: "Inventors ought to find a good field in the study of some effective means to utilize asphalt as fuel. The solution of this question would be of great service to this country. It is said that many of what were thought to be coal mines, recently discovered in various parts of Mexico, are really deposits of bitumen. Now while asphalt is highly combustible, there seems to be at present no practicable method to utilize it as fuel, owing to its melting when subjected to heat. It is likely, however, that with the demand for cheap fuel now felt all over the country for railway, mining, and other industrial purposes, some effective method may be devised to make practical use of its heat-producing qualities; burning it, perhaps, after reducing it either to a liquid or vaporized form. The inventor of such a process could command a handsome fortune for the use of the right in this country. The products of the new oil wells in Vera Cruz, much of which are said to be too heavy for illuminating purposes, might also be utilized in the same manner."

A Buried City of Liliputians.

We clip the following from the New York *Observer:*

In the summer of 1839 I spent some two or three weeks on the Cumberland Mountains in Middle Tennessee. I had been engaged in teaching, and was in need of rest, and taking a good horse rode up to the Chalybeate Springs, in White county, some twelve miles from Sparta, the county seat. These springs were on the road across the mountains, from Nashville to Knoxville, East Tennessee, and about one hundred miles from the former city.

They were kept at that time by a New England man named Beckwith, and some thirty or forty persons were there.

We heard from our host that there was a buried city of liliputians some five miles distant, through the mountain passes, and a company of five gentlemen, with a colored man for a guide, started out to make an investigation. Our road was a mere bridle path, and would have been quite impossible to find without a guide. We reached the place about noon, and at once began our inquiries. The farm was owned by Thomas Wilson, a good Scotch name, and I have no doubt a man of truth. He said when he came there, some thirty years before, the ground was covered with the largest growth of trees, poplar, sugar-maple, black-walnut, and ash. It was what was familiarly called a cone in the mountains—the soil a rich, sandy loam, and the field was then in corn. The walls of the city were in the form of an octagon, or nearly so, and enclosed about six or eight acres. They were about three feet high, made of earth and loose stones thrown up, and bore the marks of the plow, and had evidently been very much higher. To show their great antiquity, a stump of a poplar was pointed out, standing directly on the wall, that measured six feet two inches across, and must have been five hundred years old—counting the rings in an inch, and estimating the whole number in the tree. No doubt it had stood there when Columbus discovered America, and was a good-sized tree then. Running through the center of the town were two rows of houses, on each side of a street. These were mere circles of earth, only a foot or eighteen inches high, and about twelve feet in diameter. Near the center were two such circles, about thirty feet in diameter, which had probably been their council houses. These could be distinctly traced, although evidently greatly reduced by time.

But the strangest part of the story is yet to be told. Mr. Wilson told us that on the highest part of this enclosure many graves had been opened, and skeletons found. They came upon them, in the first place, while plowing. The plow struck a flat stone, and on turning it up there was found a human skeleton, of a very diminutive size. He said that about a hundred had been exhumed up to that time. They were all buried in a sitting posture, with the knees drawn up near the chin, and the hands clasped on the top of the head. A flat stone was at the bottom and on the four sides and on top. By taking an iron crow-bar, and striking it down in the mellow soil, we soon found a grave. We opened two that afternoon. In each grave there was found a vessel of some kind, usually a bowl, about the size of an ordinary pint bowl, which had undoubtedly contained food. In one of the graves which we opened, there were found four vessels, all made of clay and muscle-shell and charcoal, well worked together, and either burnt or dried in the sun. The soil was remarkably dry, and the bones and the vessels were well preserved. We found in one of these graves, in addition to the bowl, a small-sized dinner-pot, with ears on the sides just like the dinner-pots of our grandmothers. It was not like them, of iron or copper, but of this same composition with the other vessels. It would hold about three pints or perhaps two quarts, and was made quite symmetrically and with an eye to beauty. In this pot was the bone of a deer's leg, charcoal, and a muscle-shell about one and a-half inches wide and three inches in length. This was no

doubt put in for a spoon, and the piece of venison, and perhaps other perishable food, with fire, now only charcoal, for the supply of the departed, on his long journey to the happy hunting grounds, with provisions. In the same grave was a tray, about eighteen inches long, and nine inches wide, and two inches deep. Also, a small vessel that would hold, perhaps, a gill, for salt, most likely.

The bones were well preserved, and we got out the entire skeleton, even to the bones of the fingers and toes.

And now the most curious of all is to be told. The bones of the thigh and of the arm were not quite half the length of an ordinary man; so that they could not have been more than two and a half or three feet in height. They were not the bones of children, for they were hard, and children's bones of that size would have perished in a few years, being almost wholly cartilage. Beside, they had the wisdom teeth, which proved that they were adults. Then, all the graves which had been opened contained these small skeletons; not one exception. There could not have been so many infants buried in one place. In this same grave, which seemed to be that of a chief, we found on the neck two small ornaments about the size of an old-fashioned copper cent, carved out of muscle-shell, with holes through them for a string to tie them round the neck. At the head of the grave, inside of the stone casing, there was a piece of black slate about eighteen inches long and three inches wide, and three-quarters of an inch thick. We examined this slate very carefully for some hieroglyphics or letters, but found none. In the other grave which we opened we found only the ordinary bowl and the bones. Taking up our treasures in baskets, we carried them over to the hotel, and divided them among us as trophies. Mine were left in a box till called for, but I never got them. Returning by a different route through the Squeechy Valley, when I wrote for them to Mr. Beckwith, he said they had been carried away. I kept one of the mother-of-pearl ornaments in my pocket-book for many years, and I believe it is still in existence.

Why did I not write out some account of this wonderful discovery at the time? Simply because I thought it would be regarded as a hoax. E. P. PRATT.

PORTSMOUTH, OHIO, July 17, 1883.

East River Bridge.

The following facts and figures regarding the East River Bridge will be of interest to engineers throughout the world.

Length of river span, 1,595 feet 6 inches.

Length of each land span, 930 feet.

Length of Brooklyn approach, 971 feet.

Length of New York approach, 1,562 feet 6 inches.

Total length of bridge, 5,989 feet.

Width of bridge, 85 feet.

Number of cables, 4.

Diameter of each cable, 15¾ inches.

First wire was run out May 29, 1877.

Length of wire in four cables, exclusive of wrapping wire, 14,361 miles.

Length of each single wire in cables, 3,579 feet.

Weight of four cables inclusive of wrapping wire, 3,588½ tons.

Depth of tower foundation below high water, Brooklyn, 45 feet.

Depth of tower foundation below high water, New York, 78 feet.

Total height of towers above high water, 278 feet.

Clear height of bridge in center of river span above high water, at 90 degrees Fahrenheit, 135 feet.

Height of floor of tower above high water, 119 feet 3 inches.
Size of caissons, 172 × 102 feet.
Grade of roadway, 3¼ feet in 100 feet.
Height of towers above roadway, 159 feet.

The weight of the whole suspended structure (central span), cables and all, is 6,740 tons, and the maximum weight with which the bridge can be crowded by freely moving passengers, vehicles, and cars, is estimated at 1,380 tons, making a total weight borne by the cables and stays of 8,120 tons, in the proportion of 6,920 tons by the cables, and 1,190 tons by the stays. The stress (or lengthwise pull) in the cables due to the load, becomes about 11,700 tons, and their ultimate strength is 49,200 tons.—*Van Nostrand's Record.*

"Groombridge 1830."

THE GREAT STAR THAT IS RUSHING THROUGH SPACE AT THE RATE OF TWO HUNDRED MILES A SECOND, OR THEREABOUTS.

[New York World, January 8, 1883.]

There is a star called Groombridge 1830, which is known to be flying through space at such a rate of speed that the attraction of all the bodies of the universe can never stop it. Newton's first law of motion is that "a body once set in motion and acted on by no force will move forward in a straight line and with a uniform velocity forever." Groombridge 1830 is a body which has come in at one part of the borders of the universe, and having found the attraction of all the vast masses of suns, among which our own is but as a mote in the light, to be practically "no force," speeds on its way with a velocity which, in Professor Simon Newcomb's words, will, within two or three million years, carry it beyond "the extreme limit to which the telescope has ever penetrated." By this it is meant not merely that it will pass beyond the stars, for the stars, many as they are, and at absolutely incalculable distances as by far the greater number of them are, are but a handful. All of them are within or close to the galaxy of which the solar system forms a part. The streak of light in the heavens which we call the Milky Way appears as it does only because the galactic region is a circular disk, the diameter of which is eight or ten times its thickness. The sun with the earth is near the center of this disk, so that when we look towards the circumference of it we see the stars crowded together, while, when we look towards the flat side of it, they are comparatively few and scattered. The Milky Way is what we see when our eyes turn towards the circumference. If the earth were a transparent ball a man at its center would see the galaxy, with the Milky Way as a belt running completely around it. The star Groombridge 1830 is not only on its way past all these visible stars, but it will go beyond them and pass among and through the region of nebulæ by which the disk is surrounded, for the nebulæ in all probability are but collections of glowing gas—the substance of which, according to a generally received theory, suns and world are made.

No other star is known to astronomers which has a proper motion so great as that which is bearing Groombridge 1830 on its way through infinite space and which is not less than two hundred miles per second, nor does science give any account of what produced it. As has already been said, an application of Newton's first law of motion shows that upon it the attraction of the whole universe of stars is absolutely "no force" to it. The star acts as if it had once been set in motion to go on at a uniform rate of velocity forever, either alone in space or from some other distant "universe" of which nothing is and nothing ever can be known, towards some other universe compared with which our own is not even as a cloud of dust. In such a matter as this an original *impetus* is out of the question. In the starry heavens masses *fall*—they are not driven; as the moon

constantly falls towards the earth, so the planets constantly fall towards the sun. In other words, gravitation acts throughout the universe—wherever there is matter subject to this law, and therefore it is evident that this great star, wherever it came from and wherever it is going to, is doing its work in obedience to the law of attraction. A recent speculation may give an indication of what the giant star is on its way to accomplish, and this work is nothing more or less than the redistribution of the matter of some other universe than ours, which redistribution may have a serious effect upon the universe of which we are a part and parcel. The effect will be remote enough in time, and yet it is not by any means impossible that it may be felt long before the limit of years has elapsed which Professor Newcomb has assigned to the star for its disappearance from telescopic vision. Action and reaction are equal and in opposite directions. If Groombridge 1830 be moving towards some other great mass, the other is moving towards it, possibly with equal and possibly with greater velocity, and if the whole mass of the heaven of stars in our galaxy cannot arrest the path of the one it can hardly have any effect upon the other. In other words, our little universe need not be considered at all as a factor in the problem.

The speculation which has just been spoken of is founded on the Nebula theory, which is grounded solely in physics. The result of the theory is well known to be that suns will clash with suns, the heat resulting from the impact being sufficient to disperse the matter of which they consist through a space nearly, but not quite, equal to that which it occupied when the suns began to form. The process of condensation will then begin anew, and gradually form a body equal in mass to the sum of the suns which took part in the collison. The volume, of course, will be larger than any of the individual suns. Collision after collision and subsequent condensation after condensation will take place until, at a remote distance, two enormous bodies alone will remain, which will then begin to gravitate towards each other with constantly accelerating velocity, until they meet and sufficient heat results to make of the whole universe a nebula such as it is supposed to have been at first. And so, for one long swing of the pendulum of eternity, *actum est de homine*. The star Groombridge 1830, a runaway, a stranger to this poor universe of ours, is supposed to be in relation to some other star, one of two such great masses built up of the wrecks of the systems which once were a "universe" on its way to meet another of like proportions. And then the crash! If the tremendous cactaclysm take place near our system of stars it will certainly be involved in the ruin, and if remote, then such a nebula will blaze up in the heavens that we shall not have any need of sun or moon or stars forever.

A Discovery.

VALUE OF EUCALYPTUS LEAVES TO REMOVE SCALE FROM BOILERS.

It will be remembered that a few years ago there was a craze among land-owners in the counties bordering the bay of San Francisco for setting out Eucalyptus trees, and hundreds of thousands of them were planted. These trees have been found to contain qualities useful for a greater variety of purposes than probably any other natural product, but the supply has so far exceeded the demand that most of the groves have become burdens to their owners. The discovery lately of the use of the leaves as a steam boiler incrustant-preventive bids fair to largely increase the market for them. The greatest difficulty that engineers have ever found to contend with is the formation in their boilers of an incrustation from the solids contained in the water. Thousands of things have been used to prevent the formation of this "scale," as it is commonly called. Bran, potatoes, wood, cobblestones, sodium, chemical compounds, many and varied and

numberless mechanical contrivances have been tried, many to no purpose, while some were found to mitigate the evil. None were found near perfect. The incrustation eats away the shell of boilers and is almost the sole cause of explosions. A greater evil, from an economical point of view, is the loss of fuel, caused by the fact that the incrustation is one of the poorest conductors of heat. Indeed, the consumption of fuel in boilers badly "scaled" is increased in many cases as much a hundred per cent. It is estimated that the increased cost of running locomotives in the Middle and Western States averages $750 per year for each boiler. George Downie of Salinas City several months since discovered that eucalyptus leaves removed scales from a boiler of his. He associated with himself Joseph McGillivray of Oakland, and they have since made extensive experiments and, it is claimed, with the most satisfactory results. So assured are they of the value of the discovery that they have secured patents in the United States, Great Britain, Germany, and other countries.—*Examiner.*

The Scorpion.

Dr. C. J. Wills, late one of the medical officers of Her Majesty's telegraph department in Persia, in his volume on Modern Persia says that he had heard from a Swedish physician at Shiraz, that scorpions, when they see no chance of escaping capture, commit suicide: "He told me, that when one was surrounded by a circle of live coals, it ran round three times and then stung itself to death. I did not credit this, supposing that the insect was probably scorched, and so died. I happened one day to catch an enormous scorpion of the black variety. In Persia they are of two kinds, black, and light-green, or greenish-yellow; the black variety being supposed to be much the more venomous. The full-grown scorpions generally are from two to three inches long; I have seen one five inches when extended from the tip of the claws to the sting, but he was phenomenal. The one I caught was very large, and to try the accuracy of what I supposed to be a popular superstition, I prepared in my courtyard a circle of live charcoal a yard in diameter. I cooled the bricks with water, so that the scorpion could not be scorched, and tilted him from the finger-glass in which he was imprisoned unhurt into the center of the open space; he stood still for a moment, and then, to my astonishment, ran rapidly round the circle three times, came back to the center, turned up his tail (where the sting is), and deliberately, by three blows, stabbed or stung himself in the head; he was dead in an instant. Of this curious scene I was an eye-witness, and I have seen it repeated by a friend in exactly the same way since, on my telling the thing, and with exactly the same result. For the truth of this statement I am prepared to vouch."

Salt in Lime Whitewash.

A correspondent of a German paper says that a few years ago it was decided to whitewash the walls and ceiling of a small cellar to make it lighter. For this purpose a suitable quantity of lime was slacked. A workman who had to carry a vessel of common salt for some other purpose stumbled over the lime cask and spilled some of his salt into it. To conceal all traces of his mishap he stirred in the salt as quickly as possible. The circumstance came to my knowledge afterward, and this unintentional addition of salt to the lime excited my liveliest curiosity, for the whitewash was not only blameless, but hard as cement, and would not wash off.

After this experience I employed a mixture of milk of lime and salt (about three parts of stone lime to one part of salt), for a court or light well. To save the trouble and expense of a scaffold to work on, I had it applied with a hand fire engine (garden syringe?) to the opposite walls. The results were most satisfactory. For four years the weather has had no effect upon it, and I have obtained a good and cheap means of lighting the court in this way.—*Ex.*

The Locomotive.

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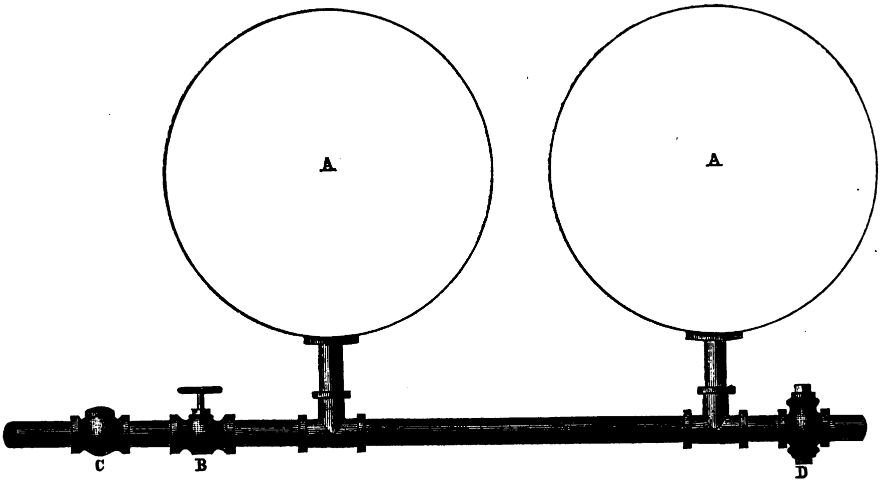
About Feed and Blow-off Attachments.

Figure 1 shows a very common form of making the feed-water connection for a battery of boilers which prevails to an uncomfortable extent in many parts of the country. It may be described as follows:



A. A.—Cross sections of two cylinder boilers,
B.—Globe valve.
C.—Check valve.
D.—Blow-off cock.

It is a very ordinary occurrence in these localities for the interior boiler of a battery to become short of water; be overheated, bulged or collapsed, and oftentimes ruptured, doing more or less damage, according to circumstances and surroundings.

With such an arrangement of pipe-connections, this is always possible, and may result from some one of the following causes: a more direct draft to the chimney or smoke-pipe; heavier firing, or cleaner boiler-sheets and tubes; allowing the fires in one furnace to become dirty and dull, while that of the adjacent furnace is clean and bright, etc.

In feeding boilers the feed-water will pass into the boiler through the connection offering the least resistance; therefore, under ordinary circumstances, the larger amount will go into the boiler nearest the supply, and I have always found it necessary in feeding several boilers upon the same line of feed-pipe to equalize the flow by partially closing the globe-valve upon the nearest boiler, and so graduating the lift of valves upon the other boilers as to make the feed uniform. But this cannot be done where boilers are connected as illustrated in Fig. 1, which is based apparently on the assumption that where the feed is on, each boiler is getting an equal amount of water. Practically this